Subject LANDFILLING HISTORY AT ETHYLENE COMPLEX

Interoffice Correspondence

SUN

Date June 2, 1989

Location Marcus Hook

File

From W. Brenner

To S. Martini

Attached to this letter is your copy of a study recently completed documenting known landfilling activities at the former SunOlin Chemical Company site covering a period of about 30 years.

W. Brenner

Walter Brenner

WB:erh
Attachment
cc: M. Wagner
WB-SCM2

SUN REFINING AND MARKETING COMPANY

MARCUS HOOK, PENNSYLVANIA

ETHYLENE COMPLEX

HISTORY OF LANDFILLING

Researched & Written By: S.L. Palese

Edited & Introduction By: W. Brenner

May, 1989

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SUN REFINING AND MARKETING COMPANY

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ETHYLENE COMPLEX

HISTORY OF LANDFILLING

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INTRODUCTION

Circa 1958 a joint venture was formed between Sun Company and Olin Chemical Company called SunOlin Chemical Company. The SunOlin production facility was located in the extreme southwest corner of the Marcus Hook Refinery bounded by Middle Creek on the North and West and the Delaware River on the South. The entire site is within the borders of the State of Delaware.

Initially, SunOlin manufactured urea for Olin with ammonia feed provided by the Sun refinery. Carbon dioxide feed for urea manufacture was provided by a Kellogg Steam-Methane reformer which also produced merchant hydrogen and carbon monoxide.

In 1961, SunOlin built Ethylene and Ethylene Oxide units with engineering-construction provided by the Lummus Company. The Ethylene Oxide Unit is a licensed Shell design. Prior to construction of these additions the construction site was a marshy swamp within the tidal plan of the Delaware River and had been used as a refuse dump.

This report documents, as far as possible, the land use history of the former SunOlin plant site including prior use, backfilling activities for plant expansion, boring records, geological formations and other pertinent information. This data was collected and recorded for this report by Sam Palese, a Civil Engineer in the employ of Sun when SunOlin was formed and then an employee of SunOlin until its purchase by Sun in 1987.

SunOlin stopped the manufacture of urea in 1973. Sun bought out Olin's interest in late 1987 and SunOlin became the Ethylene Complex of the Sun Marcus Hook Refinery on January 1, 1988.

WB:erh
5/5/89

ETHYLENE COMPLEX

HISTORY OF LANDFILLING

GEOLOGY *

It is believed that the area in which the Ethylene Complex is located was once underlaid by a very old metamorphosed sediment, probably composed mostly of mica-gneiss. During the pre-Cambrian period, a great body of igneous rock comprised chiefly of gabbro intruded into the gneiss as a batholith. The intrusion of the gabbro into the gneiss occasionally resulted in fractured rock appearing at the surface of the gabbro. This fractured rock weathered and decomposed easily because it contained large amounts of mica.

The last great epoch of geologic development in this area was the Pleistocene when sand and gravel were deposited on the decomposed rock by swollen sediment-laden streams that flowed from the great ice sheet which lay to the North of this area. This sand and gravel stratum, which is part of the Cape May Formation, is known to contain areas of decayed vegetation and buried peat bogs.

Across most of the Ethylene Complex the filled areas are underlaid by organic silts ranging in color from tan to black with varying amounts of decayed vegetation. These strata consist of very soft and highly compressible river deposits made up primarily of varved silts with thin layers of very fine sand and intermixed with decaying vegetation. The thickness of this deposit varies erratically from about two (2) feet in the northern part of the Ethylene Complex to about twenty-four (24) feet in the southern part near the river at the existing bulkhead. This highly compressible organic silt is underlaid by a stratum of silty sand and gravel.

The compact sand and gravel stratum contains occasional pockets of less firm silty soil. In various locations the upper twelve (12) inches to eighteen (18) inches of the sand and gravel layer show considerable contamination by the overlaying silt stratum. The depth of this sand and gravel stratum varies considerable from a depth of about twenty-two (22) feet below the surface at the north end of the Ethylene Complex to about forty (40) feet at the southern end close to the river. The depth of the sand and gravel layer, itself, varies considerable from about four (4) feet in some areas to about fifteen (15) feet in other areas.

Sound igneous bedrock is known to underlie the sand and gravel stratum. In many portions of the plant the sound rock

*** See Appendix A for Glossary of Geology Terms**

is overlain by several feet of decomposed rock. The top of this rock shelf seems very erratic and there appears to be no pattern as to how the shelf is running. From most indications, it seems that the depth below the ground surface to the top of the rock shelf varies from about twenty-five (25) feet in the northern end of the Ethylene Complex to about sixty-five (65) feet or more at the southern end near the river.

The depth at which the sand and gravel stratum was encountered in the numerous borings drilled throughout the plant indicates that this stratum as well as the rock shelf varies considerably from boring to boring. It appears that any attempt to interpolate the elevation of either the sand and gravel stratum or the rock shelf between widely spaced borings cannot be very accurate, especially in the area near the river.

HISTORY OF LANDFILL OPERATION:

Around the mid to late 1940's Sun Oil was using the low lying area west of Blueball Avenue and south from Middle Creek to dispose of their refinery waste. This waste consisted primarily of a mixture of spent clay catalyst and natural earth or silt, clay, sand and some gravel. This material was used to cover over other refinery waste such as building debris consisting of concrete slabs, bricks and lumber. Also, there were tin cans, steel drums, oily waste, and other miscellaneous trash dumped throughout the area. At that time, Sun had a twenty-five (25) year schedule for the completion of this land reclamation project. The schedule called for the entire area to be brought up to elevation + 15.0 feet by the end of 1969.

There was a large amount of spent clay catalyst coming from Sun Oil's 14-3 Plant that had to be disposed of in some way. People at that time thought that it could possibly be used as a fill material. They began experimenting with various mixtures in order to find a proper mix that would make a material that would compact well and would be impervious to water. They settled on two mixtures that were eventually used to fill the major part of the area that became the SunOlin Plant.

These two mixtures were made up of the following:

(1) Sun Oil's Blend "A" used:
One (1) part river silt
Two (2) parts of Plant 14-3 spent clay (oil)
(2) Sun Oil's Blend "B" used:
One (1) part river silt
One (1) part of Plant 14-3 spent clay (wax)
One (1) part natural clay

The ingredients in each blend were thoroughly mixed together with a backhoe and bulldozer before being placed in the area to be filled.

When SunOlin Chemical Company purchased approximately 33.5 acres from the Sun Oil Company about 1958, the majority of this acreage had been filled and leveled off to elevation + 15.0 feet. However, there was an area in the southeast corner of the SunOlin Plant that was still under water (Delaware River). Prior to the time of this purchase, Sun Oil had been using the area north of grid line S25+00 and west of grid line W15+50 as a dump site to dispose of their refinery waste.

The refinery waste that lays below the surface of the Ethylene Complex is similar to that specified above. Also, there are areas where some iron pyritic waste mixed in with other fill material is found. The mixture of spent clay catalyst and natural soil, as specified above, was spread over the area to cover up deposits of trash and other refinery waste. This combination of fill material was spread over the area in layers and was well compacted by using rollers and bulldozers. Test borings drilled throughout the Ethylene Complex indicate that the depth of this fill material ranges anywhere from about eight (8) feet in some areas down to a depth of as much as twenty-two (22) feet in other areas.

In 1960 after SunOlin decided to build the Ethylene Unit, Ethylene Oxide Unit and the Boiler Plant, it was necessary to fill in the area south of grid line S25+50 and east of grid line W15+50 since this area was still under water (Delaware River). This land reclamation project had to be completed within three or four months so that the Lummus Company could start construction of the SunOlin facility expansion.

In October 1960 filling this area with clean sandy clay soil was begun. This soil was purchased from a barrow-pit located outside of the refinery. The barrow pit was located on land owned by the contractor responsible for the filling operation.

Although every precaution was taken to insure that the fill was properly placed and compacted, not enough time was available to allow the area to subside and ensure against differential settlement that took place throughout the area. It was estimated at the time that there could be an area subsidence of as much as two (2) feet within a period ranging from six (6) months to one year. Area subsidence is caused by the compaction of the highly compressible silty clay stratum underlying the fill plus the compaction of the new fill itself; all being caused by the added weight of the new fill.

In general terms, the area under the Ethylene Complex is made up of a heterogenous fill consisting of a mixture of clayey silt, sand, gravel, fragments of wood, brick, and concrete, catalytic and pyritic waste, some pockets of oil, along with other miscellaneous refinery waste products. The surface of the fill in most areas was set at elevation +15.0 feet. The fill extends to depths ranging from twelve (12) feet in the northern end of the plant to about twenty-two (22) feet at the southern end near the river. Generally, the fill is moderately compact, the upper half being more compact than the lower half.

The fill in the northern part of the boiler area and the northern part of the cooling tower area was placed to elevation +12.0 feet about 1944, and in the northern end of the Ethylene Unit in the vicinity of the control room about 1954. These areas were then raised to elevation +15.0 feet about 1958. The area west of grid line W17+00 in the vicinity of the western part of the Ethylene Unit, the Oxide Unit and the Ethylene Oxide storage area was raised to elevation +15.0 feet about 1958.

The areas east of grid line W17+00 and south of grid line S25+50, this takes in the southeast end of the ethylene compressor house area, the ethylene heater area, the entire boiler area, cooling tower area, the liquid ethylene storage area, and the liquid ethylene loading areas, were filled to elevation +15.0 feet in 1960. This entire area was reclaimed from the Delaware River.

During the land reclamation project in 1960 a large area of river silt was pushed into a pocket bounded by grid lines W12+00 to W14+10 and grid lines S27+60 to S29+90. As the filling operation was progressing, a large mud wave of silt was pushed into this area. The idea was to remove the silt from the pocket using a drag line on a crane. The silt was to be removed from the plant by trucks. After that, the remaining hole was to be filled with clean earth.

A large portion of this silt was removed in order to place new fill in the area under the ethylene storage sphere, TK-1001, and the area of the pipe rack for the river crossing lines. Since the remaining area was not scheduled for use at that time, it was decided to leave the pocket of silt and cover it with fill. This was done to reduce the cost of the overall landfill project.

The remaining area of silt was covered and then a surcharge of fill was used to bring the area elevation up to +24.0 feet in 1960. A subsidence of this area of about four (4) or five (5) feet of the highly compressible silt over a period of time was expected. Today this area appears to be about elevation +19.0 feet. This means that the weight of the fill has caused some compaction of the river silt.

For location of this area see Sun R&M drawing titled "Ethylene Complex-History of Landfill" No. E-11089 dated February 2, 1989.

Buried under the surface in the area bounded by grid lines S25+60 south to S29+70 and grid lines W15+18 west to W15+68 is an old piled wooded wharf. The piled wharf is about twelve (12) to fourteen (14) feet below the surface.

For location see Sun R&M drawing titled "Ethylene Complex-History of Landfill" No. E-11089 dated February 2, 1989.

GENERAL DISCUSSION OF BORINGS

A. Borings #1 Through #6

Borings #1 through #6 were drilled during the period of January 30, 1957 through February 11, 1957.

At the time of field exploration for these borings, the elevation of the ground surface varied from +11.4 feet to +16.0 feet. Surface soils consisted of fill composed of silty loam with some gravel and cinders.

A large area in the vicinity of boring #4 was used as a garbage dump during 1956, 1957. At the time of field exploration (February 1957) four (4) feet of garbage such as ashes, tin cans, waste oil deposits, miscellaneous refinery waste had been deposited in this area.

The area encompassing borings #1, 2, 3, 5 and 6 was underlain by moderately firm silty loam with gravel and cinders which extends from ground surface to depths of about ten (10) to fifteen (15) feet. Below the silty loam very soft slough deposits were found. These slough deposits, composed mostly of silt with decayed vegetation were found to be highly compressible.

Ground water was encountered in the borings at depths ranging from five (5) to ten (10) feet below the existing ground surface.

For location of these borings see Sun R&M drawing #E-11089 for details of the profiles for these borings see the "Log of Borings" presented in the attached Appendix I.

Borings #7 through #26 were drilled during the period between November 26, 1958 and December 5, 1958.

At the time of field exploration, the site blanketed by fill material had just recently been graded to an elevation of +15.0 feet. The surface soils overlaying this area consist of fill material composed of a mixture of spent clay catalyst, natural soil, silt, gravel, wood fragments, cinders, catalytic and pyritic waste. The fill extends to depths ranging from six (6) feet to seventeen (17) feet below the ground surface. Generally, the fill is moderately compact, although occasional less compact pockets were observed. The upper few feet of the fill appear more compact than the lower fill.

The southern portion of the area encompassing borings #7 through #26 is underlain by a highly compressible slough deposit consisting mostly of dark gray organic silt with varying amounts of decayed vegetation. This highly compressible deposit begins roughly at grid line S 20+50 and increases in thickness in a southerly direction to a maximum of about sixteen (16) feet at grid line S 23+00.

Ground water table was observed to lie at a depth of approximately eight (8) to ten (10) feet below the present ground surface.

For location of these borings see Sun R&M drawing No. E-11089.

For details of the profiles for these borings see the "Log of Borings" presented in the attached Appendix B.

B. Borings #27 Through #34

Borings #27 through 34 were drilled during the period between August 9, 1960 and August 12, 1960.

By mid 1960 the major portion of the area occupied by the Ethylene Complex had been filled and graded to elevation +15.0 feet. As of August 1960 the southeast corner of the site had not been filled and was mostly under water. Sun Oil was still using the edge of this area as a garbage dump.

The location of boring #34 was under water and had to be drilled from a makeshift raft.

The fill encountered in borings #27, 28, 29, 30, 32 and #33 was composed of clayey silt with sand, gravel, occasional wood fragments and some catalytic and pyritic waste. The fill extends to depths ranging from approximately twelve (12) to twenty one (21) feet below the ground surface. Generally, this fill is moderately compact. The upper half of the fill appears to be more compact than the lower half.

In the area of borings #32 and #33 the fill was graded to elevation +12.0 feet between 1943 and 1944. The area of borings #29 and #30 was graded to elevation +12.0 feet in 1954. The area of borings #29, 30, 32, 33 was finally filled and graded to elevation +15.0 feet between 1957 and 1958. The area of borings #27 and #28 was raised to elevation + 15.0 feet in 1958.

Field exploration of the area around boring #31 revealed that the fill contained appreciable amounts of tin cans, cinders, oily chemical waste, and other miscellaneous refinery rubbish. This fill material was found to be in a very loose condition. The area of this poor material is located roughly south of grid line S 26+50 and east of grid line W 17+00. The area around boring #31 was filled between late 1950 and mid 1960.

Dark gray organic silt with varying amounts of decayed vegetation was encountered beneath the fill. This organic deposit is soft and highly compressible. The thickness of the deposit varies from four (4) feet around boring #31 to about sixteen (16) feet around boring #29.

Sound igneous bedrock is known to underlie the area. Rock generally is encountered at an elevation between twenty five (25) and thirty five (35) feet below the surface.

Ground water was observed to lie at a depth of about six (6) feet below the surface.

For location of these borings see Sun R&M drawing No. E-11089.

For details of the profile for these borings see the "Log of Borings" presented in the attached Appendix B.

C. Borings #35, 36, and 37

Borings #35, 36, and 37 were drilled between the period of November 25, 1960 and November 29, 1960.

The soils encountered in these three borings were found to be similar to the soils found around the Ethylene Complex.

These borings indicated that a relatively soft pocket of silty sand was encountered in the sand and gravel stratum at a depth of about thirty two (32) feet below the surface.

In the area around the intersection of grid line S 25+20 and grid line W 18+65 the upper portion of the fill was found to contain large portions of concrete slabs and brick fragments.

For location of these borings see Sun R&M drawing No. E-11089.

For details of the profile for these borings see the "Log of Borings" presented in the attached Appendix B.

D. Borings #38, 39, 40, 41, 42, and 43

Borings #38, 39, 40, 41, 42, and 43 were drilled on February 14, 1961 and February 15, 1961.

The fill material in the vicinity of these borings is composed of clayey silt, sand, gravel, occasional wood fragments, catalytic and pyritic waste. The surface of the fill was at approximately elevation + 15.0 feet at the time of the drilling. The fill material extends to depths ranging from about seven (7) feet in the northern area of the site to about twenty (20) feet at the southern end of the site. The fill in the southern portion of the area was placed about October 1960 and was found to be very soft and compressible.

This fill is underlain by dark gray organic silt with varying amounts of decayed vegetation. This organic deposit is soft and highly compressible. The thickness varies in depth from about sixteen (16) feet to about twenty two (22) feet. In the area around the ethylene cooling tower the organic silt is only a few-feet in thickness. Most of the organic silt in this area was completely displaced with the clean natural soil used in the filling operation back in November 1960.

A stratum of silty sand with gravel was encountered beneath the highly compressible organic silt. This compact sand and gravel stratum was found to contain occasional pockets of less firm silty soil. Sound igneous bedrock was found to underlie the sand and gravel stratum.

The ground water level observed in most of these borings was at or near the ground surface at the time the borings were taken.

For location of these borings see Sun R&M drawing No. E-11089.

Detailed descriptions of the soils encountered in these borings are shown in the "Log of Borings" presented in the attached Appendix B.

E. Boring #44

Boring #44 was drilled on August 15, 1961.

The area around boring #44 was filled and graded to elevation +16.0 feet between November and December 1960. This fill consisted of clean natural soil. The fill extends to a depth of twenty-two (22) feet and is underlain by four (4) feet of natural, moderately firm, silty clay. This in turn is underlain by twelve (12) feet of compact sand and gravel. Under this sand and gravel layer is a ten (10) foot stratum of slightly compressible very fine silty sand. Bedrock was encountered at a depth of forty-nine (49) feet below the ground surface.

For location of this boring see Sun R&M drawing No. E-11089.

Detailed description of the soils encountered in this boring is shown in the "Log of Borings" presented in the attached Appendix B.

F. Borings #45, 46, and 47

Borings #45, 46, and 47 were drilled on September 19, 1962 and September 20, 1962.

Borings #45 and 46 indicated that the area is underlain by about fourteen (14) feet of heterogeneous fill consisting of sand, silt clay, gravel, wood, and catalytic waste mixed with some miscellaneous refinery waste. The fill is underlain by compressible river deposits which extend to depths ranging from thirty-six (36) feet below the ground surface at boring #45 to about forty-two (42) feet at boring #46. These compressible soils are primarily varved silts with thin layers of very fine sand and occasional decayed vegetation. The silty soils are underlain by a sand and gravel layer. It was noted that the upper twelve (12) to eighteen (18) inches of the sand and gravel stratum, in both borings, showed considerable contamination by the over lying silt.

Sound bedrock was encountered at a depth of forty one and one half (41.5) feet below the ground surface at boring #45 and at a depth of forty five (45) feet in boring #46.

Boring #47 indicated approximately eighteen (18) to nineteen (19) feet of heterogenous fill similar to that in borings #45 and #46. Sound bedrock was encountered about forty eight (48) feet below the ground surface.

For location of these borings see Sun R&M drawing No. E-11089.

Detailed description of the soils encountered in these borings are shown in the "Log of Borings" presented in the attached Appendix B.

G. Borings #48 Through 57

Borings #48 through #57 were drilled between the period of October 1, 1987 through October 26, 1987.

These ten (10) borings were drilled by Groundwater and Environmental Services, Inc. (GES) in order to perform an environmental site assessment of the property of the SunOlin Chemical Company. This assessment was relative to a planned property transfer of the SunOlin Chemical Plant to Sun Refining and Marketing Company.

The ten (10) drilling sites were selected and located to provide maximum site coverage as well as to address site areas of particular interest. Based on these criteria, nine (9) borings were located around the perimeter of the property and one within the plant complex.

Results of these ten (10) borings indicated findings similar to those mentioned earlier in the report as far as subsurface composition, fill material, and the presence of silts in the fill areas.

Analytical data from groundwater samples taken during period of October 1, through October 26, 1987, indicated a limited and relatively insignificant presence of petroleum hydrocarbons, volatile organic compounds, acid and base/neutral extractables. Localized notable concentrations of lead and ammonia as nitrogen in groundwater and total petroleum hydrocarbons in soils were detected. In addition, nitrogen and sulfate were detected in soil samples.

Indeterminate petroleum and/or chemical-type odors were noted during the drilling of all ten borings. In general, the strongest such odors were noted from black silts. Additionally, an oily sheen was observed on much of the black silt samples. Petroleum/chemical type odors were also detected both above and below the water table in sands and lighter colored silts. It should be noted, that this petroleum/chemical type odor could be the result of naturally occurring methane, which is commonly present in marsh deposits (decayed vegetation) such as those found in the organic silts underlying the site.

The ground water elevations in the ten (10) borings across the area fall in the range between five (5) to twelve (12) feet below the ground surface. These elevations are running true to the depth of ground water found in all of the other borings drilled throughout the Ethylene Complex. The groundwater level data established by the fifty-seven (57) borings indicate a highly irregular static water surface, suggesting significant influence due to heterogeneity of subsurface materials and as well as tidal fluctuations.

For location of these borings see Sun R&M drawing No. E-11089.

Detailed description of the soils encountered in these borings are shown in the "Log of Borings" presented in the attached Appendix B.

For additional detailed information concerning any of the data specified above, refer to the report titled " Subsurface Site Assessment - SunOlin Chemical Plant" prepared by GES, Inc., and dated October 28, 1987.

This report is located in the files of the Environmental Department at Sun Refining and Marketing Company, Marcus Hook Refinery, and at the Risk Management Department at 10 Penn Center.

H. River Sediment Analyses

In March 1955, during a dredging operation, a sample of sediment was taken from the bottom of the Delaware River approximately one hundred (100) feet south of Sun's #2 wharf. This sample was sent to the Sun Refinery Laboratory for analysis.

The laboratory's analysis of this sample indicated that the coarser material (that remaining on a 200 mesh screen) represented 27% of the total dry sample and was largely sand, mica, gravel, etc. The remaining fines material (that passed through a 200 mesh screen), represented 73% of the total dry sample was silt.

Qualitative chemical analysis revealed that the material was largely silica, alumina, with a somewhat lesser amount of iron. Some sodium and magnesium were present along with a trace of calcium.

In June 1955 another sample of sediment was taken from the bottom of the Delaware River and sent to the Refinery Laboratory for analysis. The laboratory's analyses of this sample indicated that the coarser material (that remaining on a 200 mesh screen) represented 22.4% of the total dry sample and was mainly small stones and sand. The remaining finer material (that passing through a 200 mesh screen) represented 77.6% of the total dry sample and was all river silt.

Emission Spectrographic analysis revealed a preponderance of silica and alumina, a small amount of iron, and a smaller amount of magnesium and sodium and traces of calcium, nickel, chromium, vanadium, etc.

Since a large portion of the area that makes up the Ethylene Complex was once covered by the Delaware River, it can be concluded that these two samples are indicative of the organic silt that presently underlies the area.

SLP:erh
WB-HL13
5/5/89

APPENDIX A

GLOSSARY OF GEOLOGICAL TERMS

GEOLOGICAL PERIODS

CAMBRIAN	PERTAINING TO THE EARLIEST DIVISION OF THE PALEOZOIC ERA AND THE LOWEST SYSTEM OF PALEOZOIC ROCKS.
PALEOZOIC	PERTAINING TO AN ERA OF GEOLOGICAL HISTORY FROM THE PROTEROZIC TO THE MESOZOIC. IN THE LATER EPOCHS OF THIS PERIOD LAND PLANTS, AMPHIBIANS, AND REPTILES FIRST APPEARED.
PLEISTOCENE	PERTAINING TO OR DESIGNATING THE EPOCH JUST BELOW THE PRESENT EPOCH, DURING WHICH CANADA, NORTHERN UNITED STATES, NORTHERN EUROPE, AND NORTHERN ASIA WERE LARGELY COVERED WITH ICE. (THE PLEISTOCENE OR GLACIAL, EPOCH OF DEPOSITS).

SOME COMMON GEOLOGY TERMS:

BATHOLITH	A LARGE, IRREGULAR MASS OF IGNEOUS ROCK OFTEN FORMING THE CORE OF MOUNTAIN RANGES. A GREAT MASS OF INTRUDED IGNEOUS ROCK WHICH STOPPED IN ITS RISE, FROM WITHIN THE EARTH, CONSIDERABLY BELOW THE SURFACE OF THE GROUND.
GNEISS	A LAMINATED OR FOLIATED METAMORPHIC ROCK, CORRESPONDING IN COMPOSITION TO GRANITE OR SOME OTHER FELDSPATHIC PLUTONIC ROCK. COARSE-GRAINED, BANDED ROCK LIKE GRANITE BUT HAVING LAYERED COMPONENTS.
GABBRO	ANY OF A FAMILY OF GRANULAR, IGNEOUS ROCKS ESSENTIALLY OF PLAGIOCLASE WITH A FERROMAGNESIUM MINERAL AND ACCESSORY IRON ORE. (PLAGIOCLASE - TRICLINIC FELDSPAR IN GENERAL AS THE SODA-LIME GROUP).
HETEROGENEOUS	CONSISTING OF PARTS OR ELEMENTS THAT ARE DISSIMILAR OR UNRELATED.
IGNEOUS	ROCK FORMED BY THE ACTION OF GREAT HEAT WITHIN THE EARTH, AS ROCKS CONSOLIDATED FROM A MOLTEN STAGE, ROCKS FORMED BY SOLIDIFICATION OF MOLTEN MAGMA.
LOAM	LOOSE-TEXTURED SOIL CONSISTING OF A MIXTURE OF SAND AND CLAY CONTAINING ORGANIC MATTER.
METAMORPHOSED	CHANGE IN THE CONSTITUTION OF ANY ROCK - A PRONOUNCED CHANGE EFFECTED BY PRESSURE, HEAT AND WATER, RESULTING IN A MORE COMPACT AND CRYSTALLINE CONDITION.
MICA	A GROUP OF MINERAL SILICATES CRYSTALLIZING IN MONOCLINIC FORMS THAT READILY SEPARATE INTO TOUGH, VERY THIN TRANSPARENT AND FLEXIBLE LAMINAE.

MOTTLED	MARKED WITH SPOTS OF DIFFERENT COLOR OR SHADES, BLOTCHED OR SPOTTED (APPEARANCE OF MARBLE).
SILT	AN EARTHY SEDIMENT CONSISTING OF FINE PARTICLES OF ROCK AND SOIL SUSPENDED IN AND CARRIED BY WATER.
SLAUGH	AREA OF DEEP MUD OR MIRE WITH DECAYED VEGETATION.
VARVED	CONSISTING OF VARIOUS SILTS MARKED WITH SEVERAL COLORS OR SHADES.

SLP:erh
A:WB-HL17
5/5/89

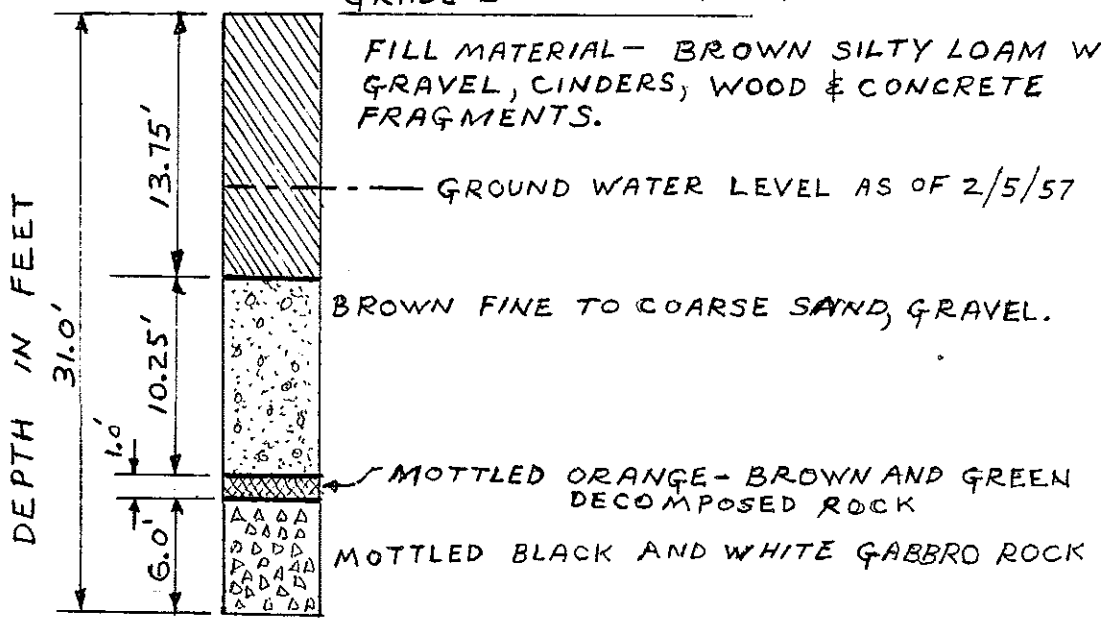
APPENDIX B

LOG OF BORINGS

DATE OF TEST BORING # 1 = JAN. 30, 1957

SHEET 1 OF 57

BORING LOCATION : W 18+60 ; S 20+60



NOTE : GRADE ELEVATION BASED ON SUN OIL ELEVATION OF 15.00 FT

FOR LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DWN: S.L. PALESE DATE: 1/11/57 SCALE: 1" = 10'-0"

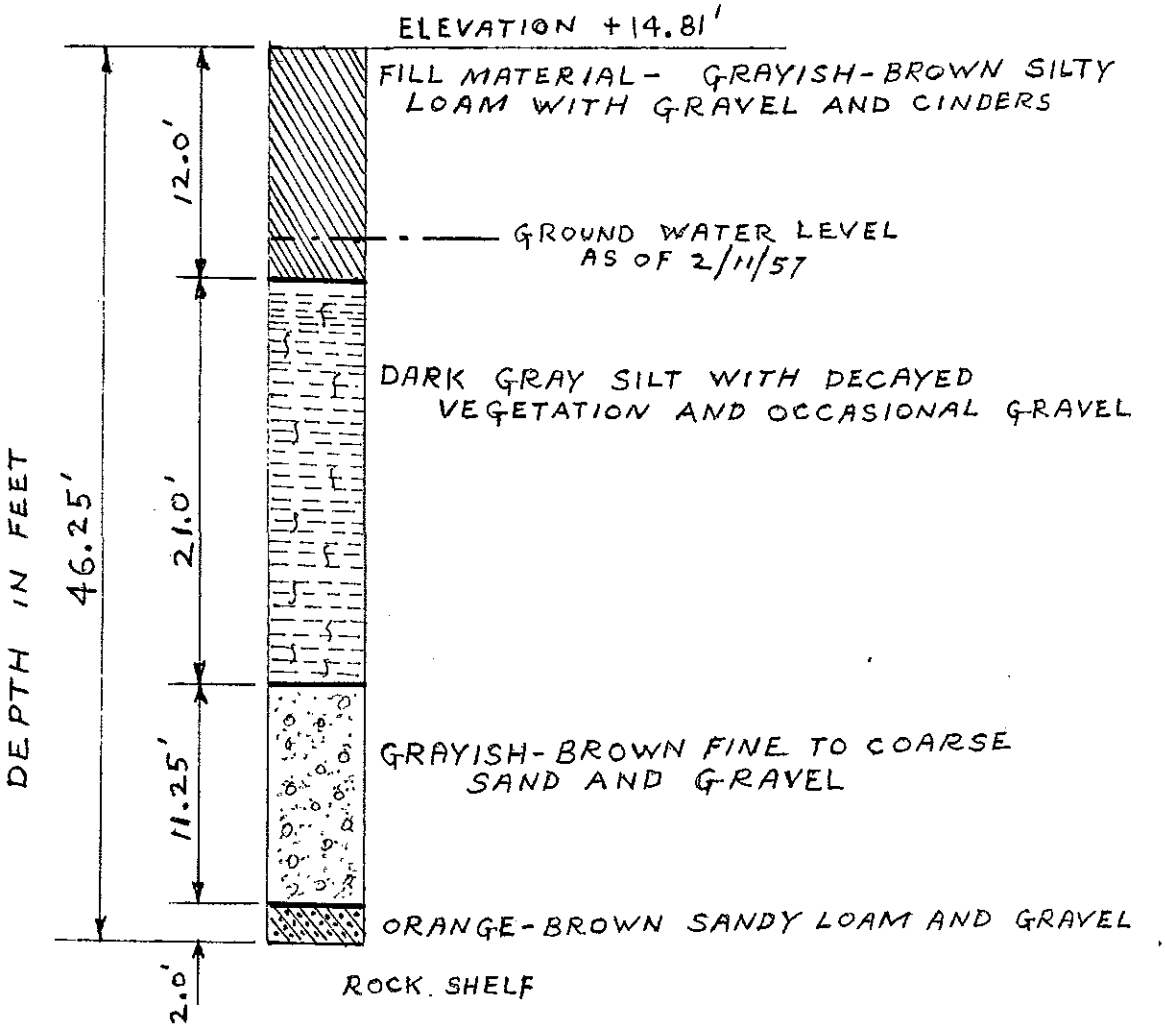
LOG OF BORING NO. 1
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

SUN—41424

DATE OF TEST BORING #2 = FEB. 11, 1957

BORING LOCATION : W 18+60; S 23+70



CHEMICAL ANALYSES OF SOIL SAMPLE:

DEPTH (IN FEET)	SOIL CLASSIFICATION	pH VALUE
17.5'	GRAY SILT WITH DECAYED VEGETATION AND OCCASIONAL GRAVEL.	6.5

NOTE: GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DWN: S.L. PALESE
DATE: 1/11/89
SCALE: 1"=10'-0"

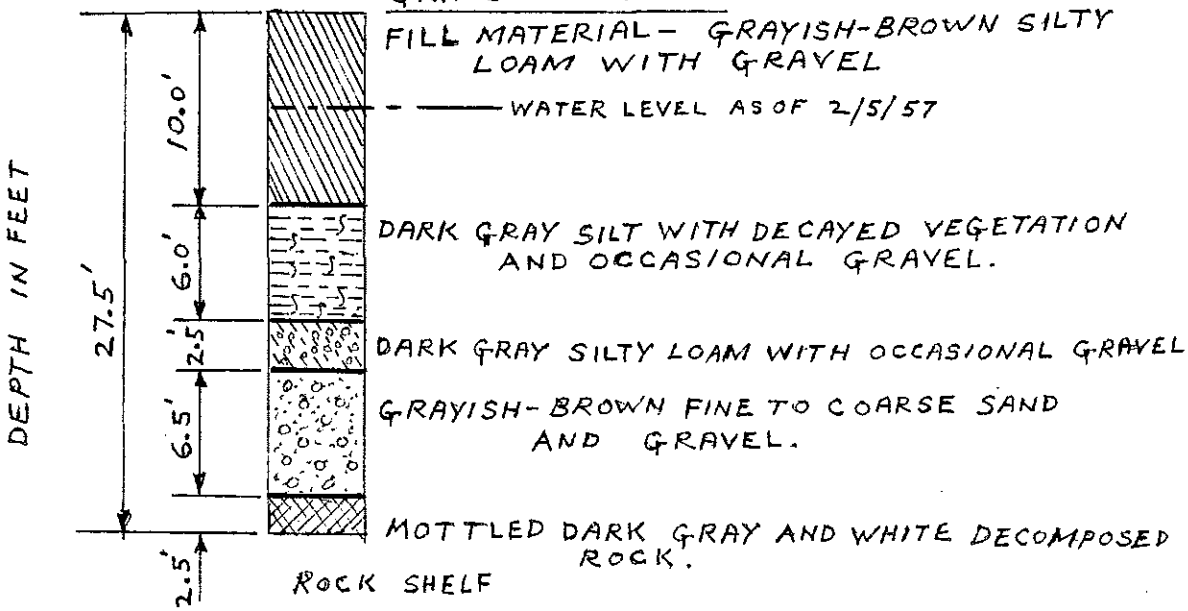
LOG OF BORING NO. 2
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

SUN--41424

DATE OF TEST BORING #3 = JAN. 30, 1957

BORING LOCATION : W 15+80 ; S 20+60



CHEMICAL ANALYSES OF SOIL SAMPLE :

DEPTH (IN FEET)	SOIL CLASSIFICATION	pH VALUE
5.0'	SILTY LOAM WITH GRAVEL	7.0.

NOTE : GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF. + 15.0 FT

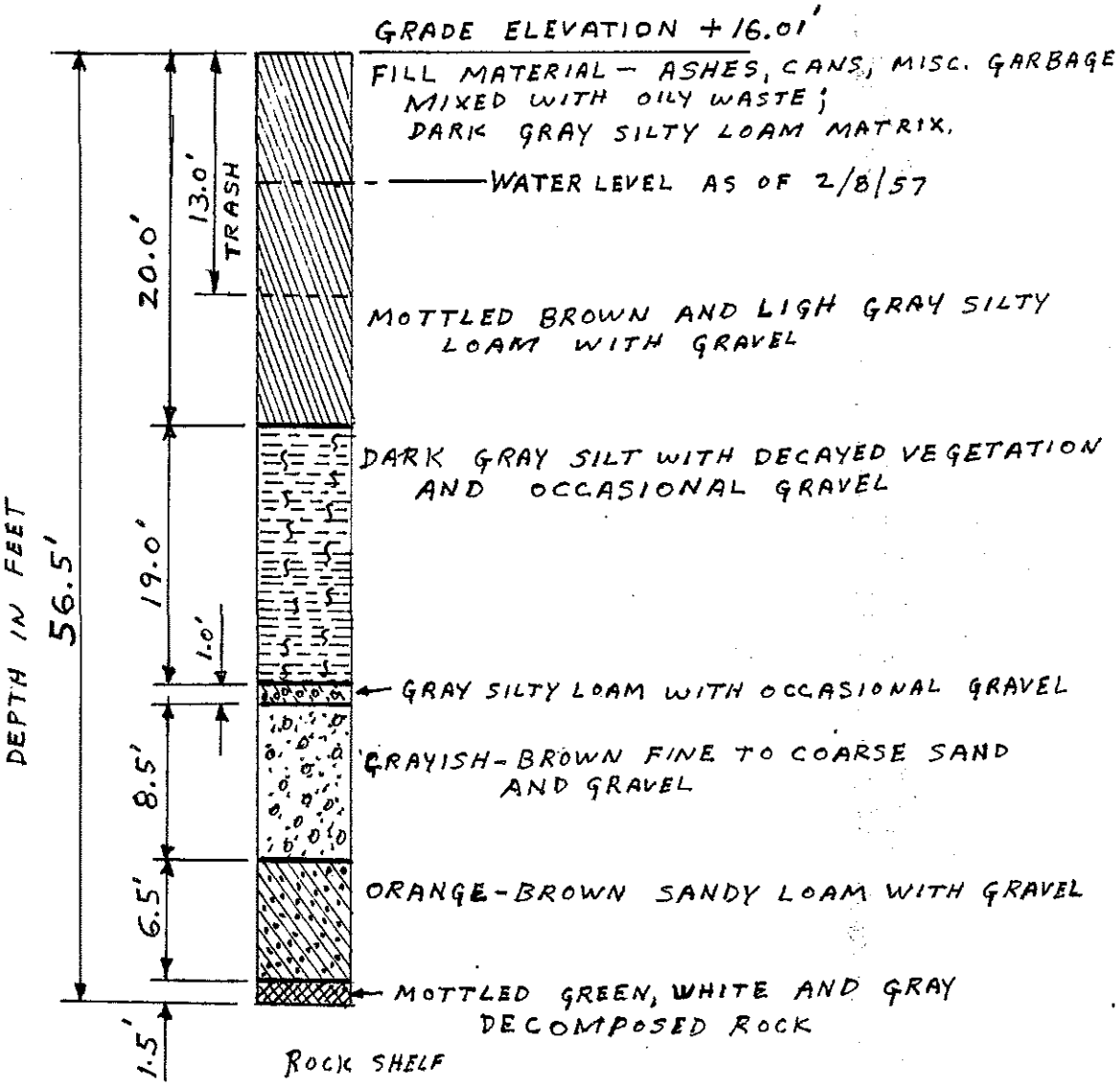
FOR LAY OUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DWN: S.L. PALESE
DATE: 1/11/89
SCALE: 1"=10'-0"

LOG OF BORING NO. 3
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF TEST BORING #4 = FEB. 7, 1957
BORING LOCATION: W15+80; S 23+90



DWN: S.L. PALESE
DATE: 1/12/89
SCALE: 1"=10'-0"

LOG OF BORING NO. 4
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

CHEMICAL ANALYSES OF SOIL SAMPLE:

DEPTH (IN FEET)	SOIL CLASSIFICATION	pH VALUE
17.0'	SILTY LOAM WITH GRAVEL.	6.2

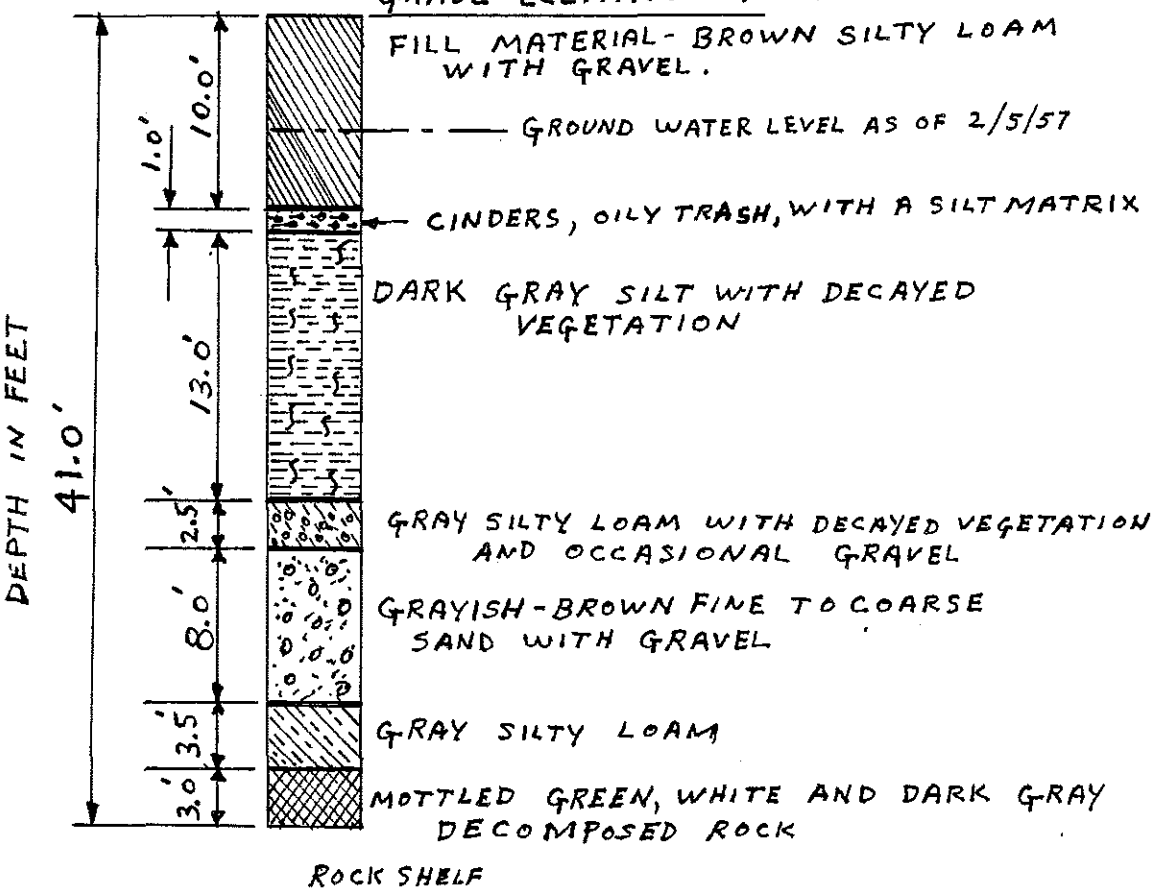
NOTE;

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089.

DATE OF TEST BORING # 5 = FEB. 4, 1957

BORING LOCATION: W 13+00; S 20+60



DWN: S.L. PALESE
DATE: 1/12/89
SCALE: 1" = 10'-0"

LOG OF BORING NO. 5
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

CHEMICAL ANALYSES OF SOIL SAMPLE:

DEPTH (IN FEET)	SOIL CLASSIFICATION	pH VALUE
5.0'	SILTY LOAM WITH GRAVEL	6.6

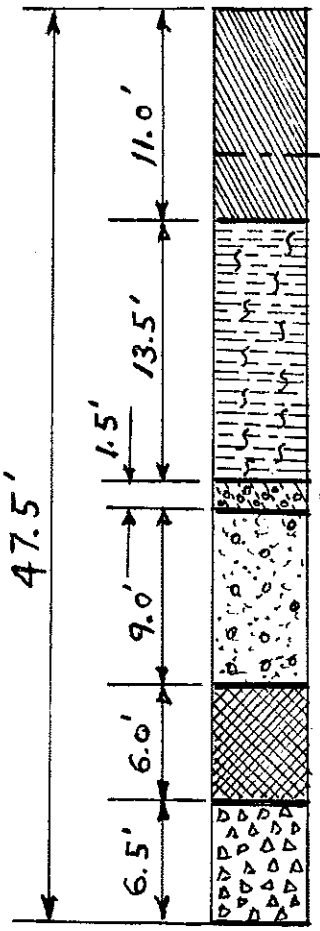
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.00 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF TEST BORING #6 = JAN. 28, 1957

BORING LOCATION : W 13+00 ; S 23+70



GRADE ELEVATION +13.21'

FILL MATERIAL – MOTTLED BROWN AND LIGHT GRAY SILTY LOAM WITH GRAVEL, CINDERS, AND BRICK FRAGMENTS.

GROUND WATER LEVEL AS OF 2/5/57

DARK GRAY SILT WITH DECAYED VEGETATION AND OCCASIONAL GRAVEL.

GRAY SILTY LOAM WITH OCCASIONAL GRAVEL

BROWNISH-GRAY FINE TO COARSE SAND AND GRAVEL.

MOTTLED GREEN, WHITE AND DARK GRAY DECOMPOSED ROCK.

MOTTLED BLACK AND WHITE GABBRO ROCK

DWN: S.L. PALESE
DATE: 1/13/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 6
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

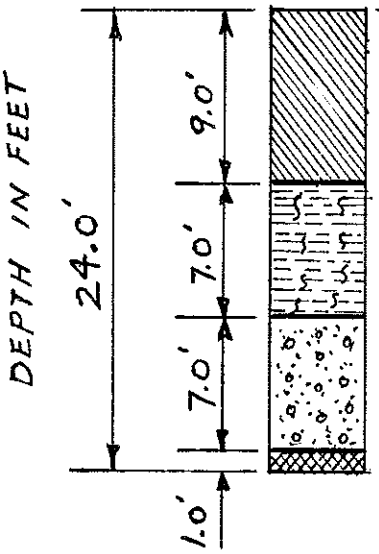
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF TEST BORING # 7 = DEC. 3, 1958

BORING LOCATION : W 16+60 ; S 19+80



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF BROWN SILT, SAND, CLAY WITH GRAVEL, WOOD AND BRICK FRAGMENTS. SPENT CLAY CATALYST WASTE. RED IRON PYRITIC WASTE.

GRAY TO LIGHT BROWN SILT WITH DECAYED VEGETATION.

BROWN SILTY SAND AND GRAVEL

MOTTLED GREEN, WHITE AND GRAY DECOMPOSED ROCK.

DWN: S.L. PALESE
DATE: 1/13/89
SCALE: 1"=10'-0"

LOG OF BORING No. 7
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

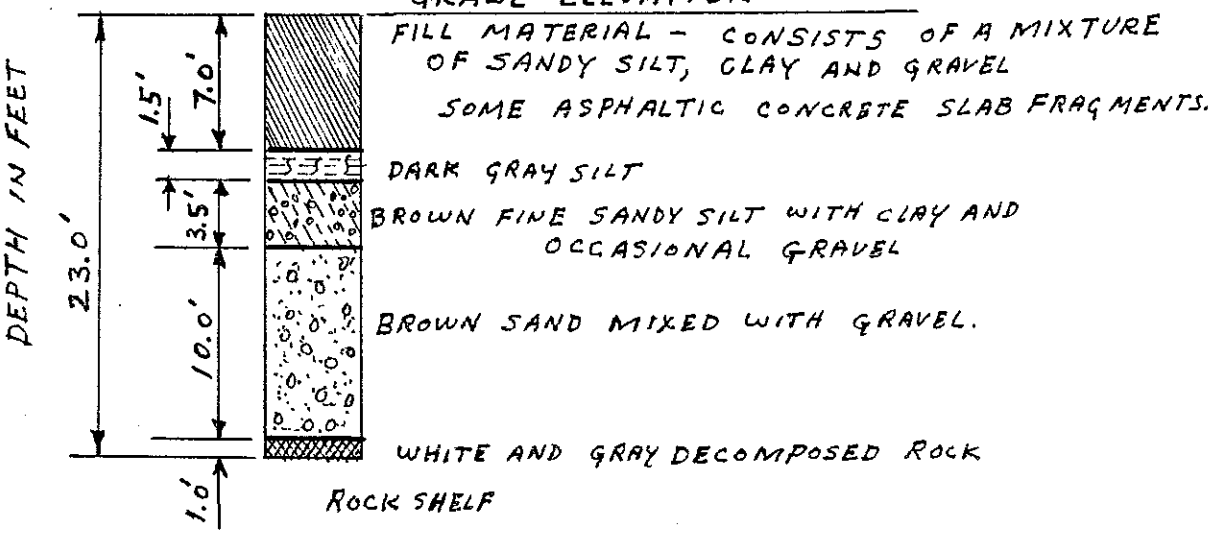
NOTE :

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF +15.0 FT.

FOR LOCATION LAYOUT OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF TEST BORING #8 = DEC. 4, 1958

BORING LOCATION: W17+50; S19+90



DWN: S.L. PALESE
DATE: 1/13/89
SCALE: 1"=10'-0"

LOG OF BORING No. 8
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

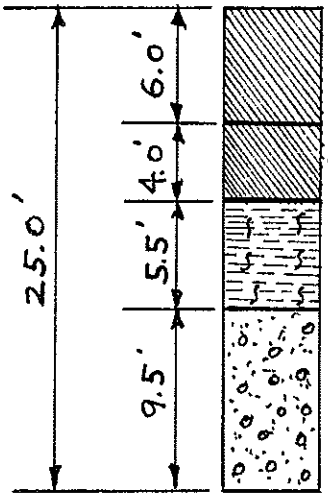
NOTE:

GRADE ELEVATION BASED ON SUN. OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF TEST BORING # 9 = DEC. 5, 1958

BORING LOCATION : W 17+50; S 20+50



GRADE ELEVATION + 15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF BROWN CLAYEY SILT, SAND, GRAVEL, AND WOOD FRAGMENTS. RED IRON PYRITIC WASTE

FILL - LIGHT BROWN AND GRAY SILTY CLAY MIXED WITH SPENT CLAY CATALYST WASTE

DARK GRAY ORGANIC SILT WITH DECAYED VEGETATION

BROWN SAND WITH SOME GRAVEL

GRADING MORE GRAVEL

DWN: S.L. PALESE
DATE: 1/13/89
SCALE: 1"=10'-0"

LOG OF BORING No. 9
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

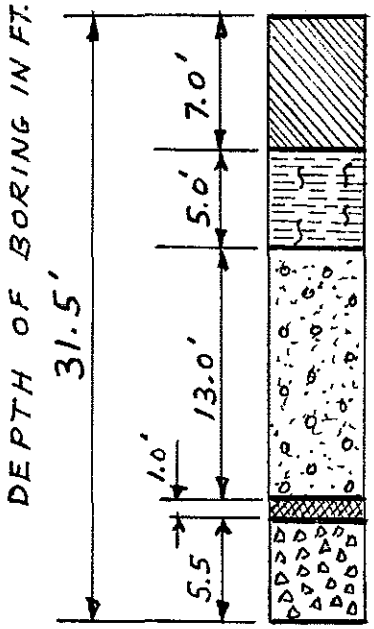
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089.

DATE OF TEST BORING # 10 = DEC. 4, 1958

BORING LOCATION: W18+45; S 20+00



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTING OF A MIXTURE OF BROWNISH-GRAY CLAYEY SILT, SAND, GRAVEL, CONCRETE FRAGMENTS, CONCRETE SLAB CHUNCKS DARK GRAY SILT, CINDERS

BROWN CLAYEY SILT WITH SOME SPENT CLAY CATALYST WASTE

BROWN SAND AND GRAVEL MIXTURE

← DECOMPOSED GABBRO ROCK

GABBRO BEDROCK

DWN: S.L. PALESE
DATE: 1/16/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 10
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

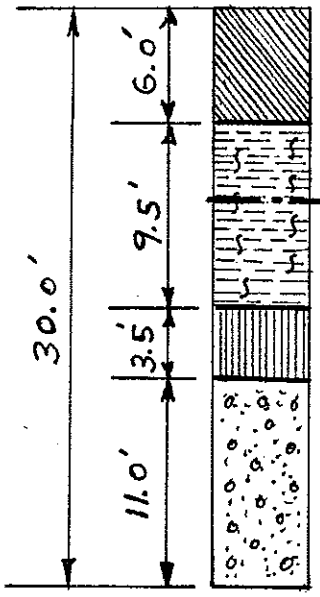
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEV. OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 11 = DEC. 4, 1958

BORING LOCATION : W 18+30; S 21+15



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF SILT CLAY, SAND AND GRAVEL WITH BRICK, WOOD AND CONCRETE FRAGMENTS. SPENT CLAY CATALYST WASTE

DARK GRAY ORGANIC SILT WITH MUCH DECAYED VEGETATION

WATER LEVEL AS OF 12/5/58 @ 9.0'

GRAY CLAYEY SILT WITH SOME DECAYED VEGETATION

GRAY SILTY SAND WITH SOME GRAVEL

GRADING MORE GRAVEL

DWN: S.L. PALESE
DATE: 1/16/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 11
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

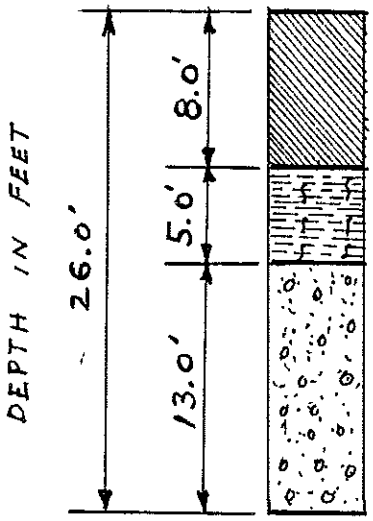
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 12 = DEC. 1, 1958

BORING LOCATION : W 19+20; S 20+60



GRADE ELEVATION + 15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF SAND, SILTY CLAY, SANDY SILT, GRAVEL AND SPENT CLAY CATALYTIC WASTE

MOTTLED DARK GRAY AND BROWN SILT WITH POCKETS OF LIGHT BROWN SILTY SAND

BROWN SILTY SAND AND GRAVEL

DWN: S.L. PALESE
DATE: 1/17/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 12
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

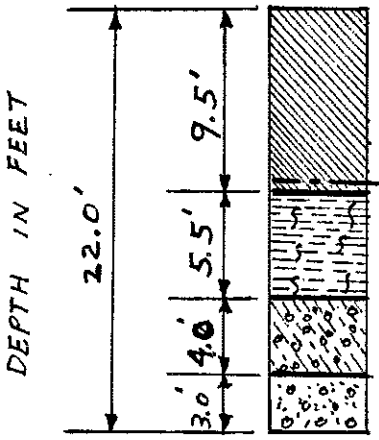
NOTE :

GRADE ELEVATION BASED ON SUN OIL PLANT ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #13 = DEC. 2, 1958

BORING LOCATION: W19+20; S21+10



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF BROWN SAND, SILT AND CLAY WITH OCCASIONAL GRAVEL AND WOOD FRAGMENTS.
SPENT CLAY CATALYTIC WASTE AND CINDERS
RED IRON PYRITIC WASTE
WATER LEVEL AS OF 12/4/58 @ 9.0'

DARK GRAY ORGANIC SILT WITH DECAYED VEGETATION.

LIGHT BROWNISH-GRAY FINE SILTY SAND WITH DECAYED VEGETATION.

BROWN SILTY SAND WITH SOME GRAVEL

DWN: S.L. PALESE
DATE: 1/17/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 13
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

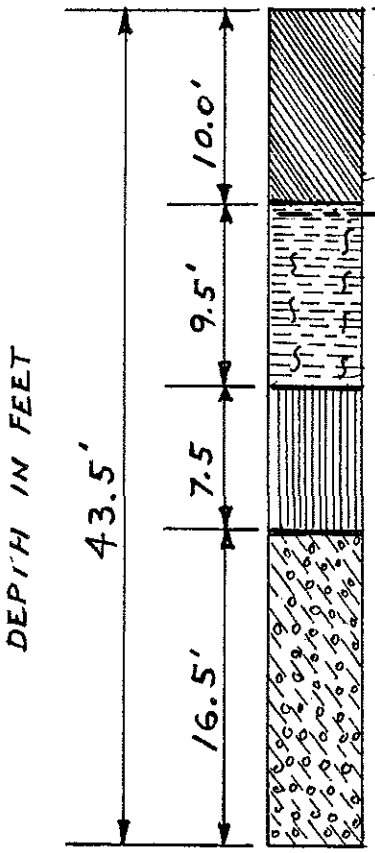
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 14 = NOV. 28, 1958

BORING LOCATION : W 19+20; S 21+60



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF SANDY SILT, GRAVEL, BRICK FRAGMENTS, POCKETS OF BROWN SILTY CLAY AND SPENT CLAY CATALYTIC WASTE.

GROUND WATER LEVEL AS OF 12/4/58 @ 10.5'

DARK GRAY ORGANIC SILT WITH DECAYED VEGETATION AND FRAGMENTS OF DECAYED WOOD.

GRAY CLAYEY SILT WITH SOME DECAYED VEGETATION.
SOME GRAVEL.

GRAYISH-GREEN FINE SILTY SAND

DWN: S.L. PALESE
DATE: 1/17/89
SCALE: 1"=10'-0"

LOG OF BORING No. 14
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

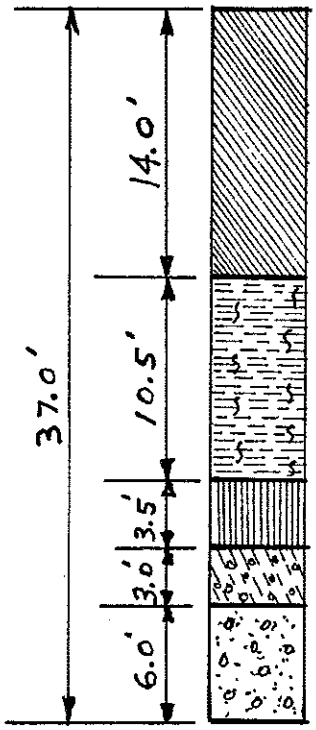
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #15 = NOV. 28, 1958

BORING LOCATION : W 19+20; S 22+50



GRADE ELEVATION +15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF BROWN SAND, SILT AND CLAY WITH SOME GRAVEL, WOOD FRAGMENTS AND BLACK SPENT CLAY CATALYTIC WASTE, SOME OIL.

GRADING DARK BROWNISH-RED SAND & SILT WITH WOOD FRAGMENTS AND GRAVEL

DARK GRAY ORGANIC SILT AND MUCH DECAYED VEGETATION

GRAYISH-GREEN CLAYEY SILT

GREENISH-GRAY CLAYEY SAND AND GRAVEL

GRAY SAND AND GRAVEL

DWN: S.L. PALESE
DATE: 1/18/89
SCALE: 1"=10'-0"

LOG OF BORING No. 15
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

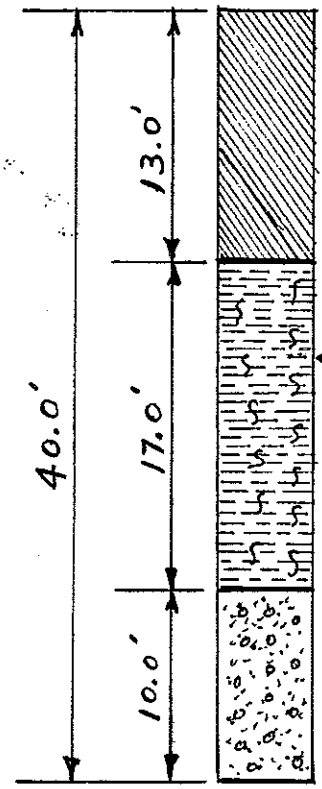
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 16 : NOV. 26, 1958

BORING LOCATION : W 19+20; S 23+00



GRADE ELEVATION + 15.0'

FILL MATERIAL — CONSISTS OF A MIXTURE OF BROWN SAND, SILT AND CLAY WITH SOME GRAVEL AND WOOD FRAGMENTS.
SPENT CLAY CATALYTIC WASTE

MOTTLED BROWNISH-GRAY AND REDDISH BROWN CLAYEY SILT WITH WOOD FRAGMENTS.
SOME RED IRON PYRITIC WASTE

DARK GRAY ORGANIC SILT AND DECAYED VEGETATION WITH SOME FILL MATERIAL MIXED

FILL MATERIAL GRADING OUT

GRAY SILTY SAND WITH SOME SMALL GRAVEL

GRADING MORE GRAVEL - BROWN IN COLOR AND LESS SILT.

DWN: S.L. PALESE
DATE: 1/18/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 16
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

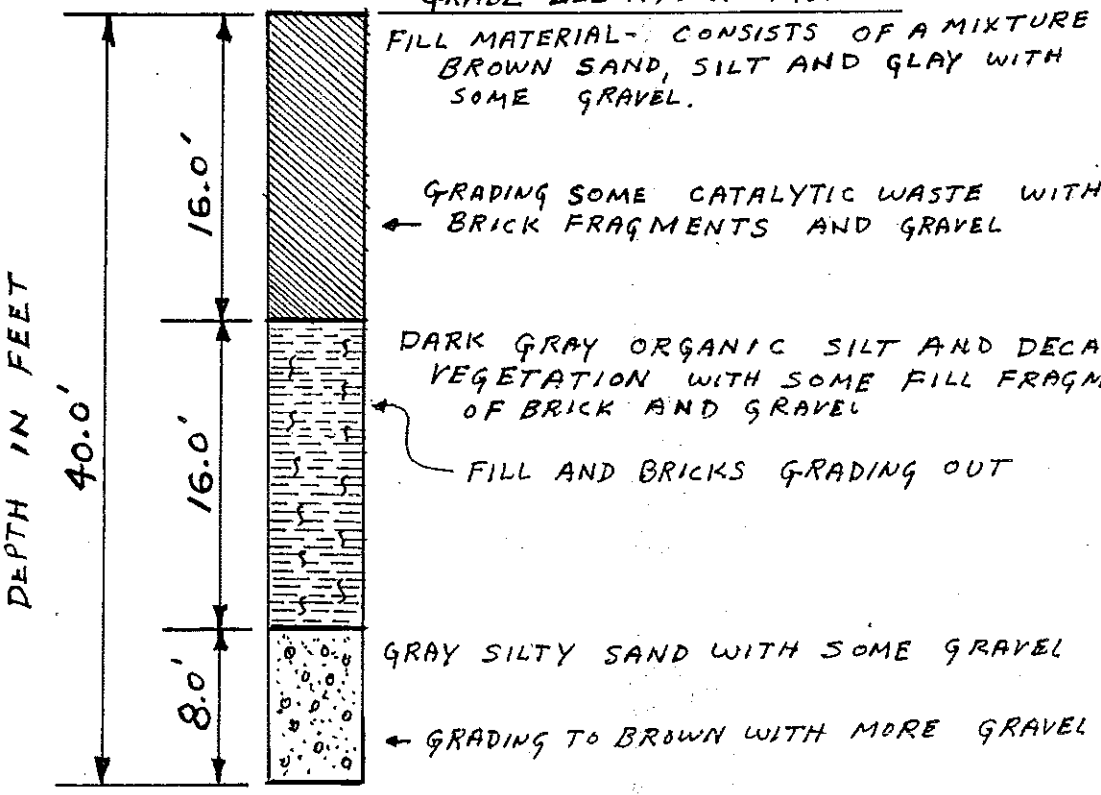
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION. OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #17 = NOV. 28, 1958

BORING LOCATION : W 20+00; S 23+00



DWN: S.L. PALESE
DATE: 1/18/89
SCALE: 1"=10'-0"

LOG OF BORING No. 17
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

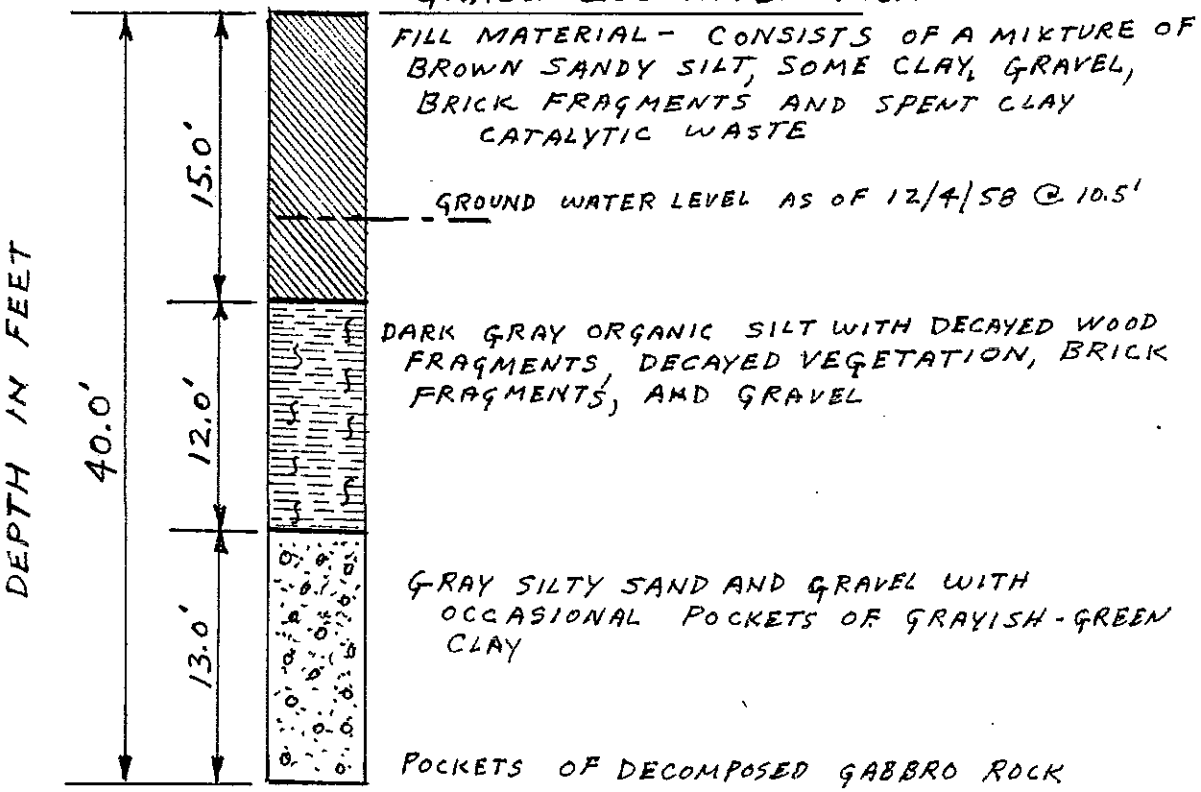
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 18 = NOV. 28, 1958

BORING LOCATION: W 20+00; S 22+20



NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

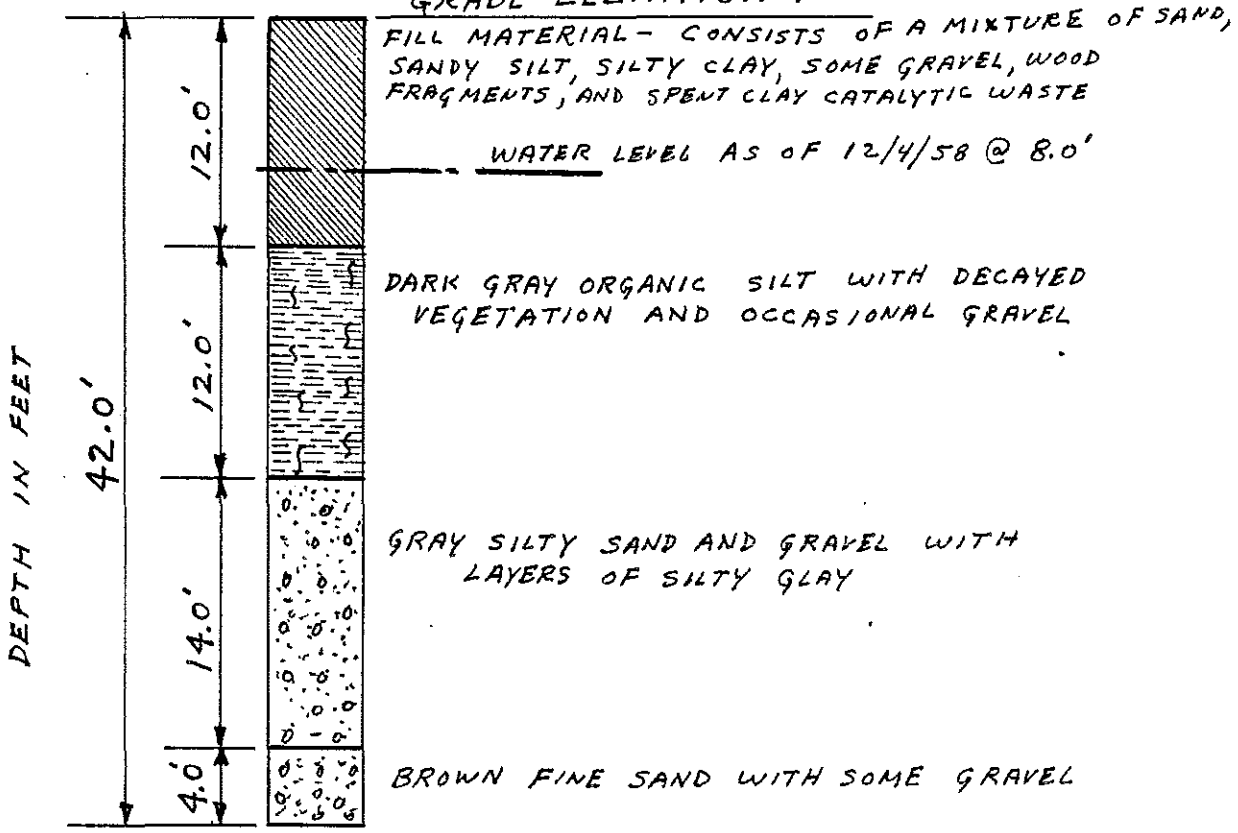
DWN: S.L. PALESE
DATE: 1/19/89
SCALE: 1"=10'-0"

LOG OF BORING No. 18
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #19 = DEC. 1, 1958

BORING LOCATION : W 20+00; S 21+60



DWN: S.L. PALESE
DATE: 1/19/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 19
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

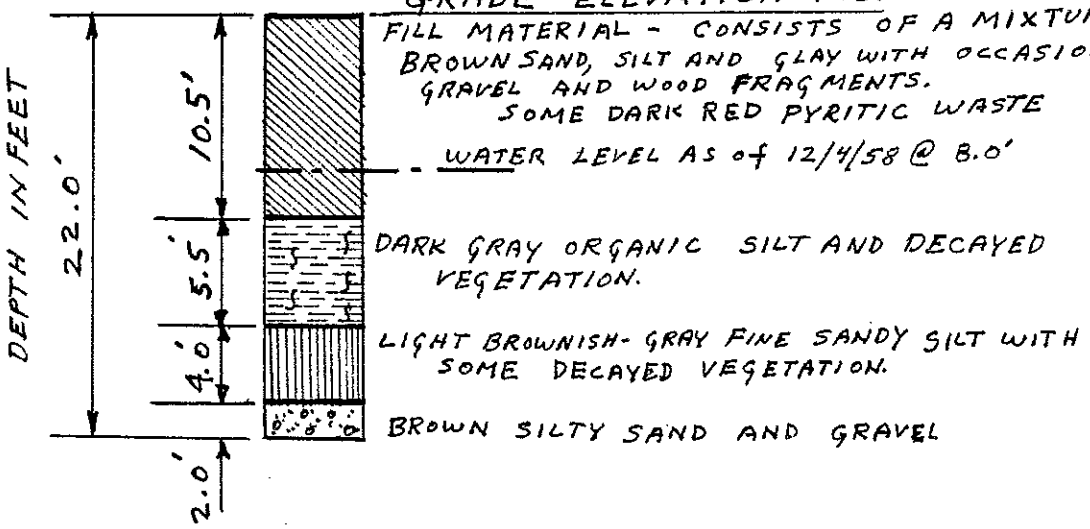
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089.

DATE OF BORING #20 = DEC. 2, 1958

BORING LOCATION : W20+00; S 21+10



DWN: S.L. PALESE
DATE: 1/19/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 20
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

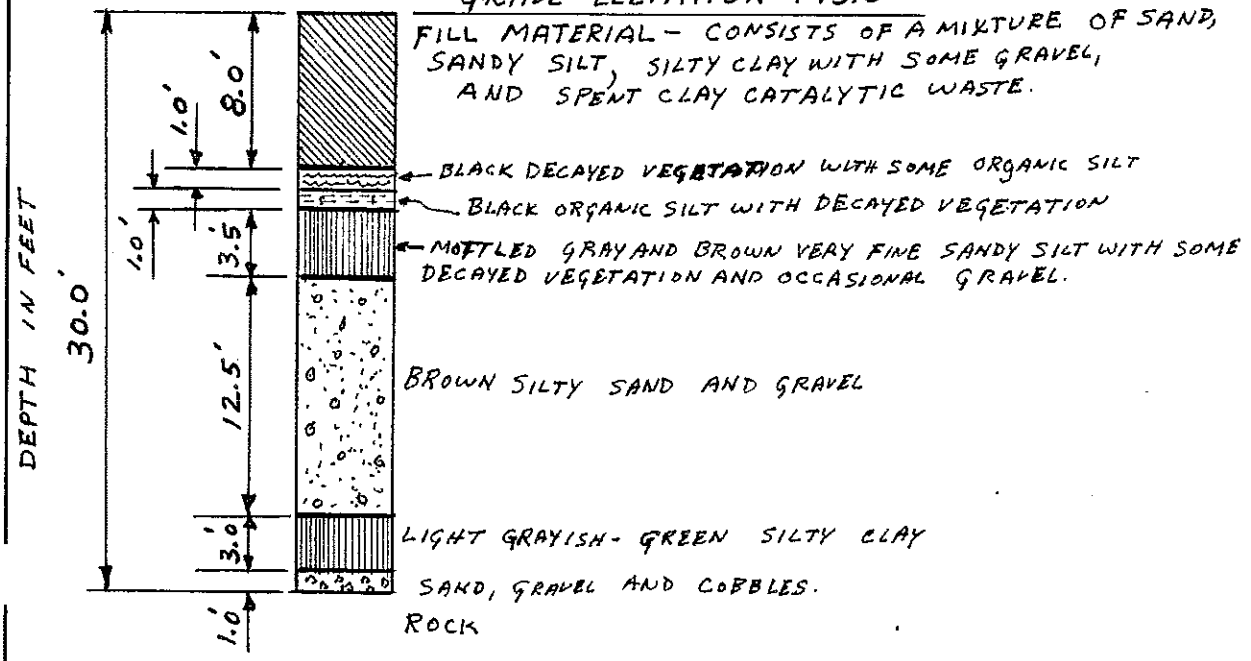
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 21 = DEC. 1, 1958

BORING LOCATION : W 20+00; S 20+60



NOTE :

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

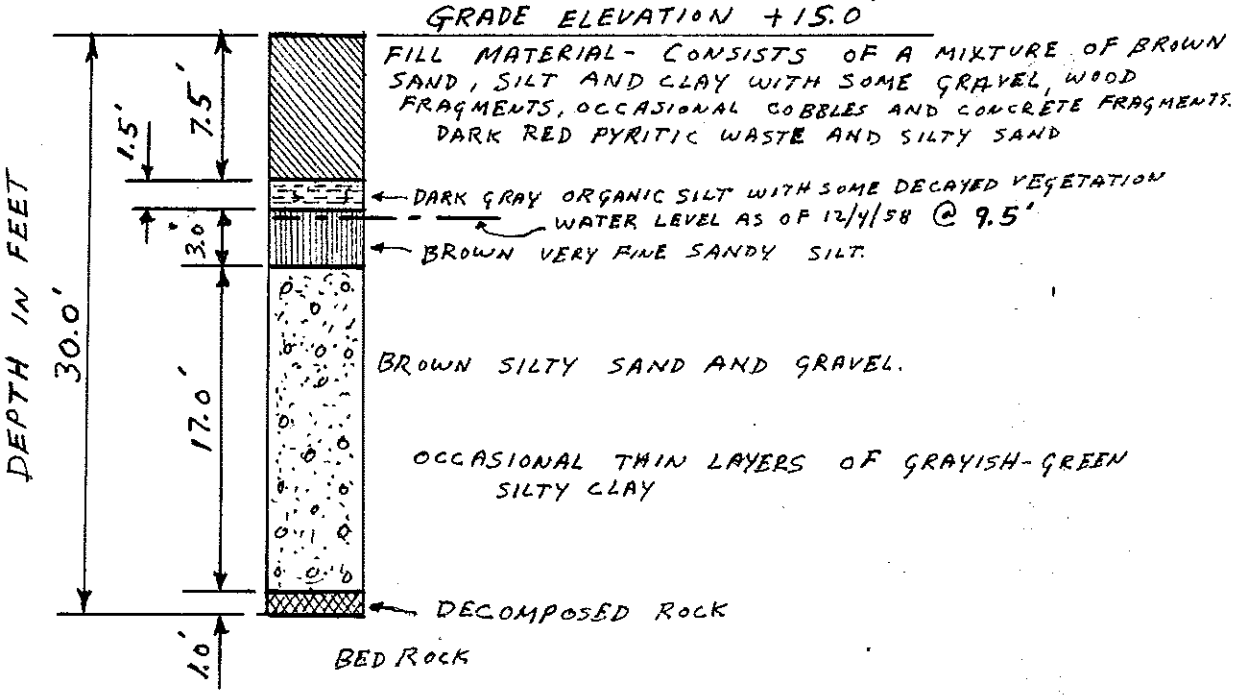
DWN: S.L. PALESE
DATE: 1/20/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 21
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #22 = DEC. 2, 1958

BORING LOCATION : W19+50 ; S 20+00



DWN: S.L. PALESE
DATE: 1/20/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 22
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

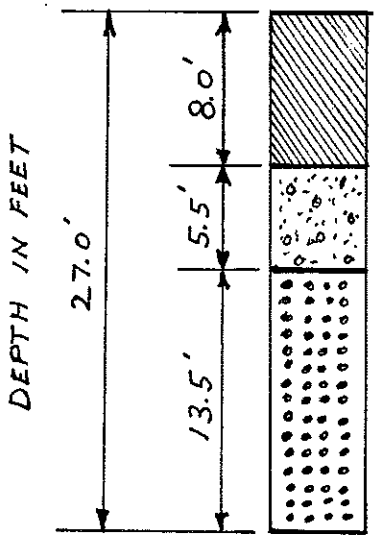
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LOCATION LAYOUT OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #23 = DEC. 3, 1958

BORING LOCATION : W20+90; S17+70



GRADE ELEVATION + 15.0'

FILL MATERIAL - CONSISTS OF A MIXTURE OF DARK BROWNISH-GRAY SILT, GRAY AND BROWN CLAY, BROWN SAND WITH OCCASIONAL GRAVEL, WOOD FRAGMENTS, CINDERS AND CONCRETE FRAGMENTS. METAL PLATE FOUND @ 4.0 FT.

BROWN FINE SILTY SAND WITH SOME GRAVEL.

MEDIUM TO COARSE SAND WITH MUCH GRAVEL AND COBBLES

DWN: S.L. PALESE
DATE: 1/23/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 23
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

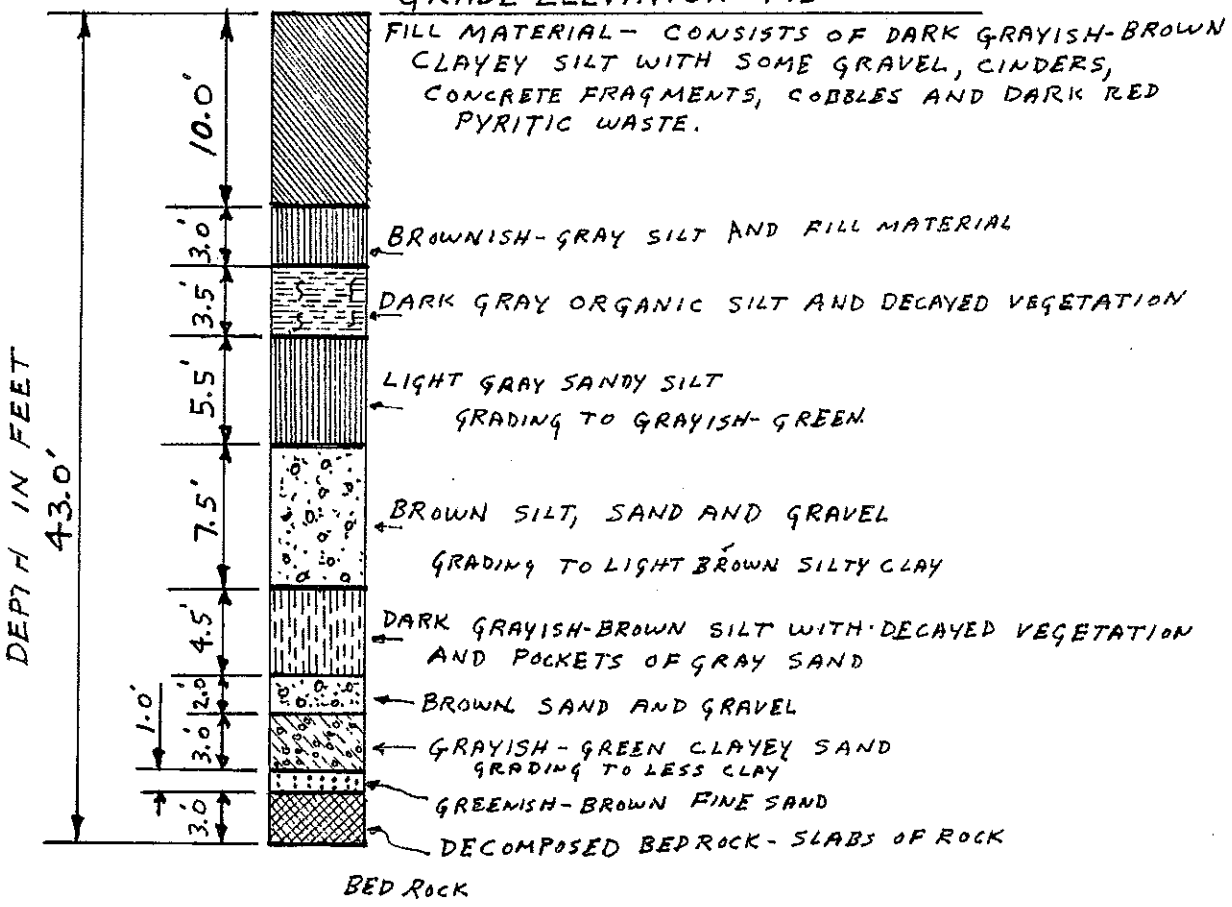
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 24 = DEC. 3, 1958

BORING LOCATION : W 15+35 ; S 16+75



DWN: S.L. PALESE
DATE: 1/23/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 24
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

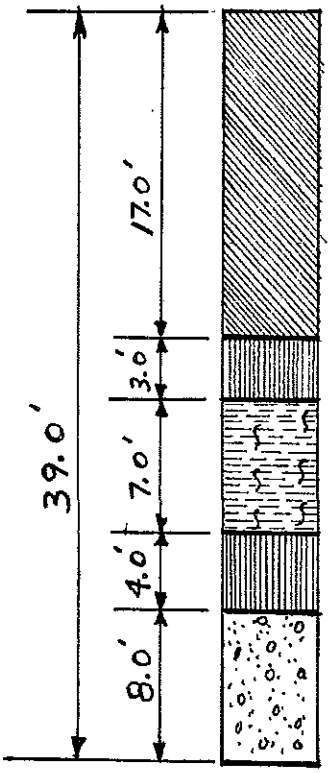
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 25 : DEC. 5, 1958

BORING LOCATION : W 20+00; S 26+50



DWN: S.L. PALESE
DATE: 1/24/89
SCALE: 1"=10'-0"

LOG OF BORING No. 25
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

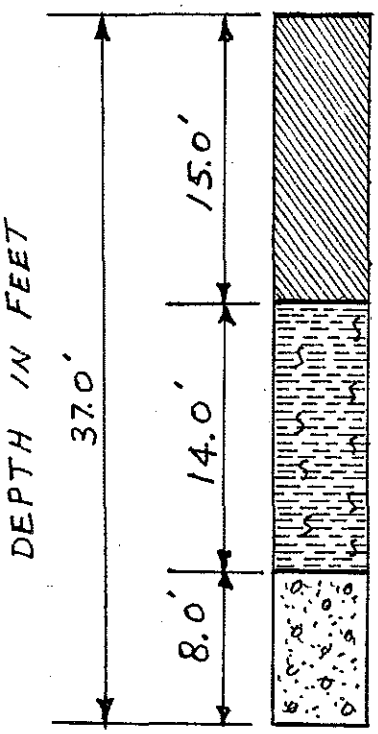
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 26 = DEC. 5, 1958

BORING LOCATION : W 20+00; S 29+00



GRADE ELEVATION +15.0'

FILL MATERIAL - BROWN CLAYEY SILT WITH BRICK FRAGMENTS, GRAVEL AND WOOD FRAGMENTS
BLACK CATALYTIC WASTE

WOOD SLAB

DARK GRAYISH-BROWN SILT WITH LAYERS OF BROWN AND YELLOW VERY FINE SAND

OCCASIONAL GRAVEL

GRAY SAND AND GRAVEL

DWN: S.L. PALESE
DATE: 1/24/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 26
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

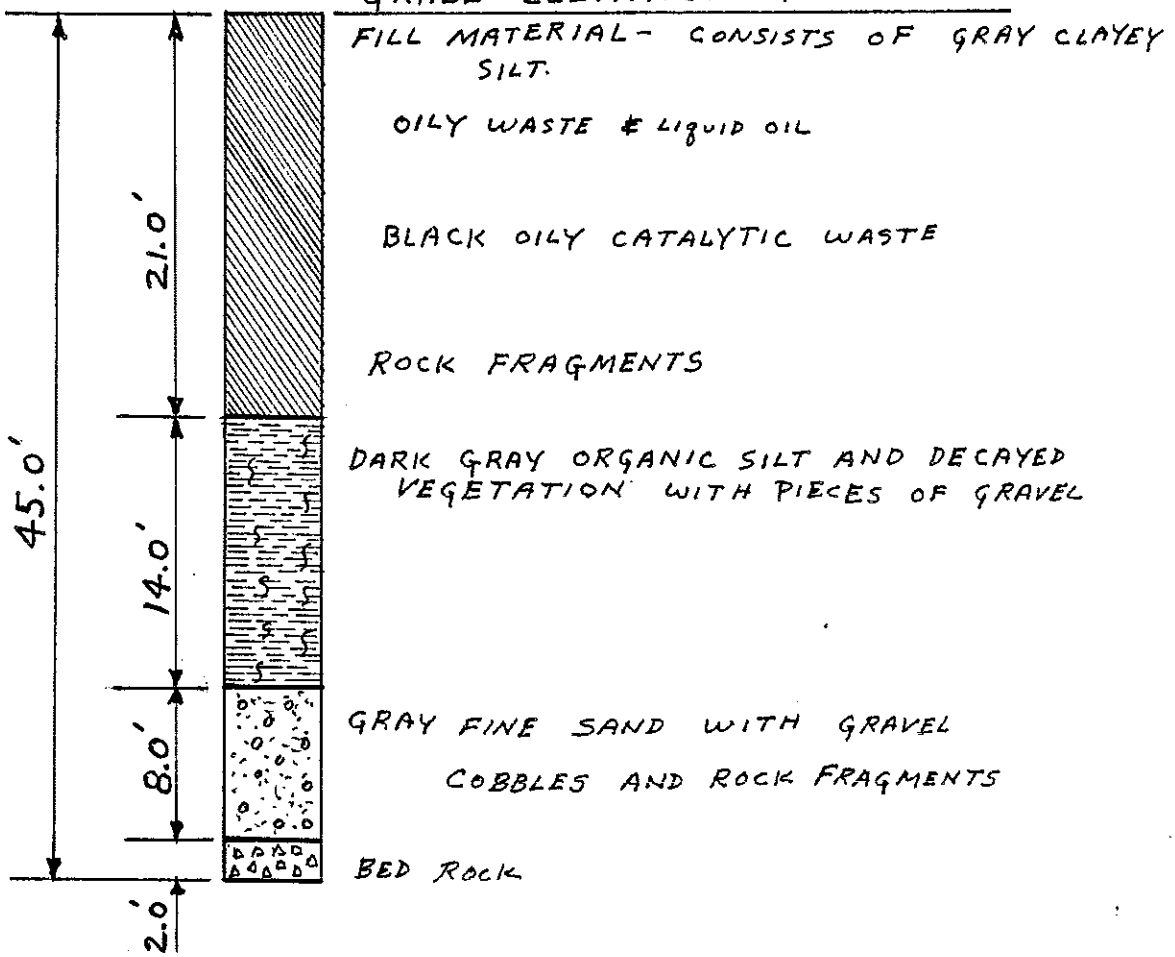
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #27 = AUG. 9, 1960

BORING LOCATION : W 18+90; S 25+60



DWN: S.L. PALESE
DATE: 1/25/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 27
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

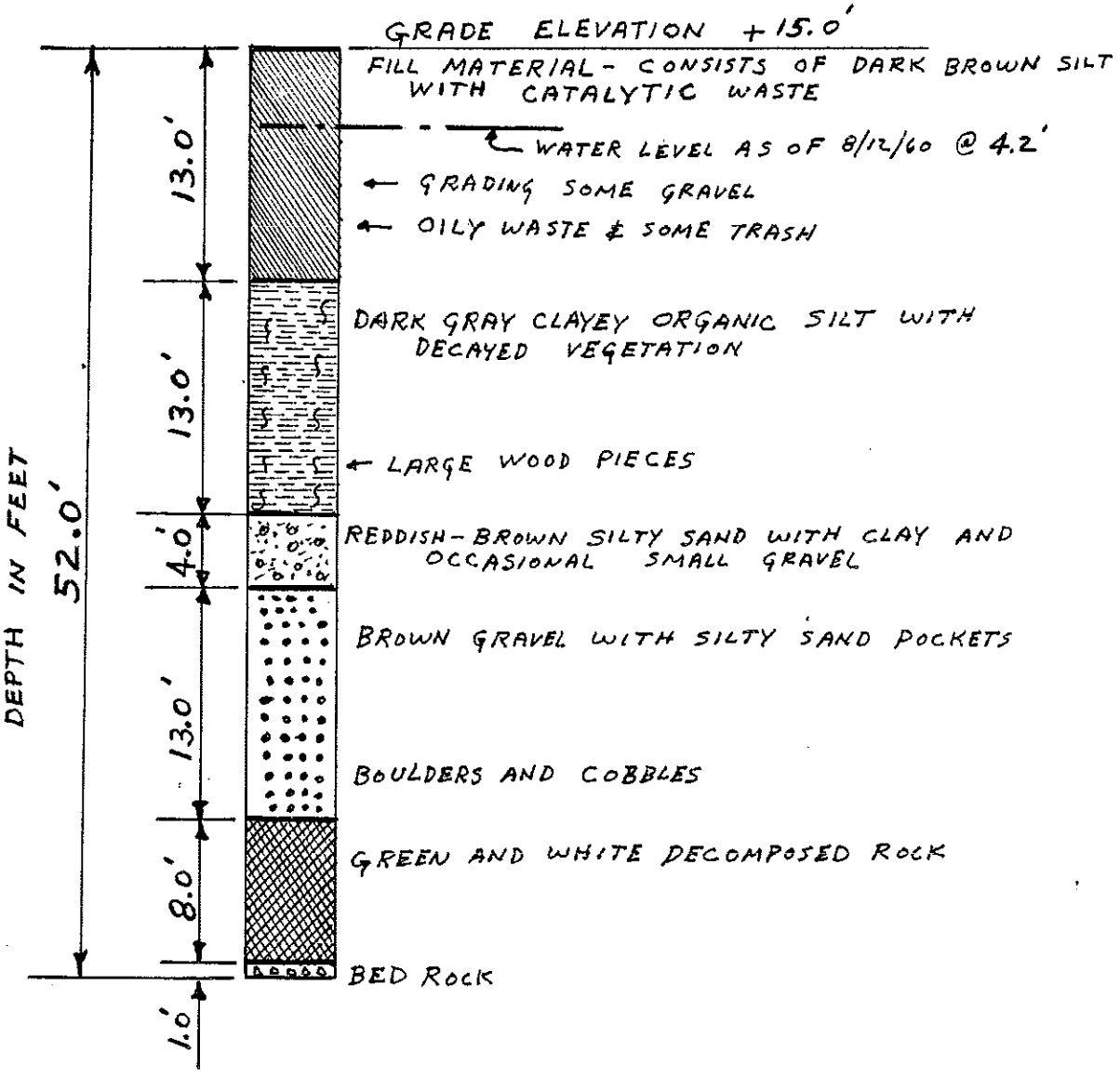
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #28 = AUG. 12, 1960

BORING LOCATION: W 18+00; S 26+50



DWN: S.L. PALESE
DATE: 11/25/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 28
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

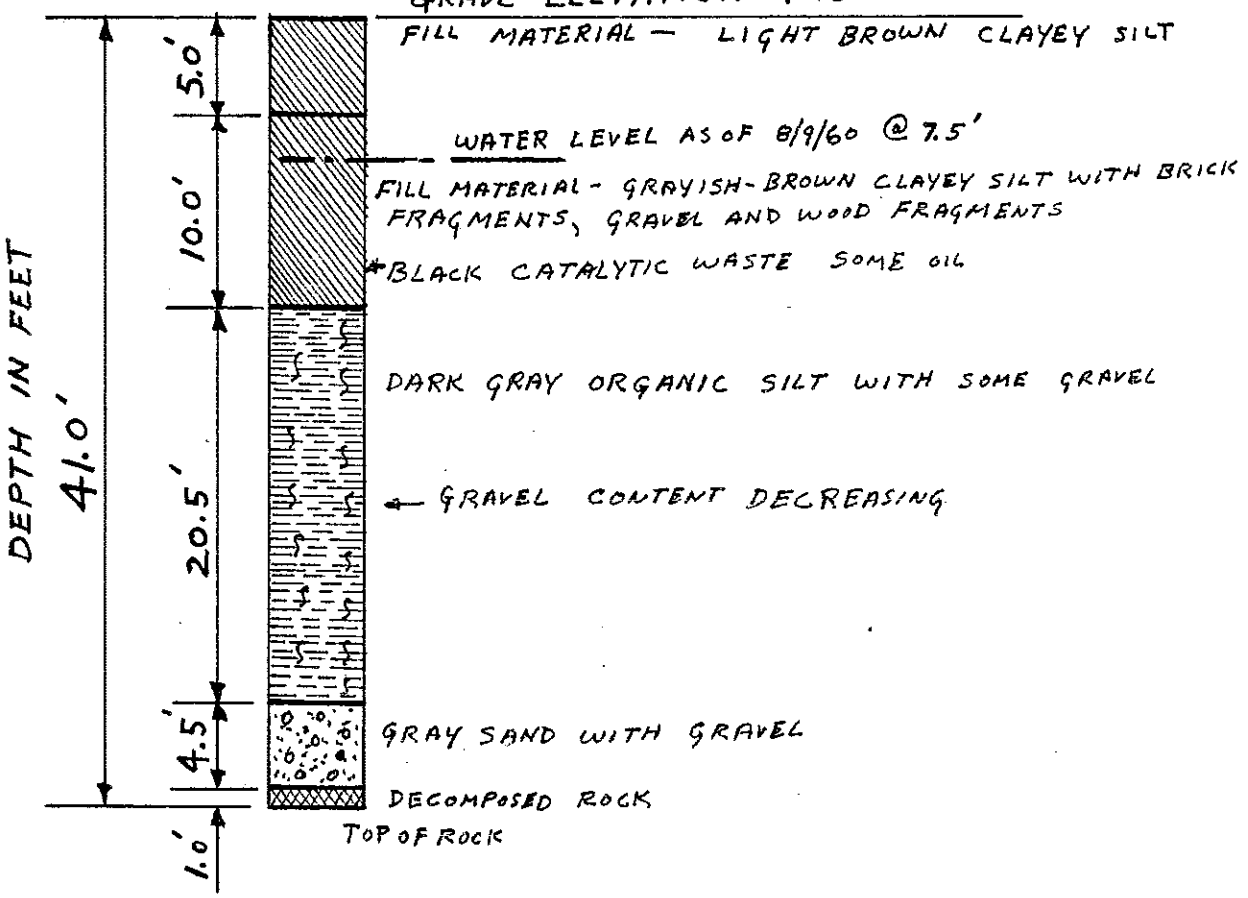
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #29 = AUG. 9, 1960

BORING LOCATION : W 17+80; S 24+70



DWN: S.L. PALESE
DATE: 1/26/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 29
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

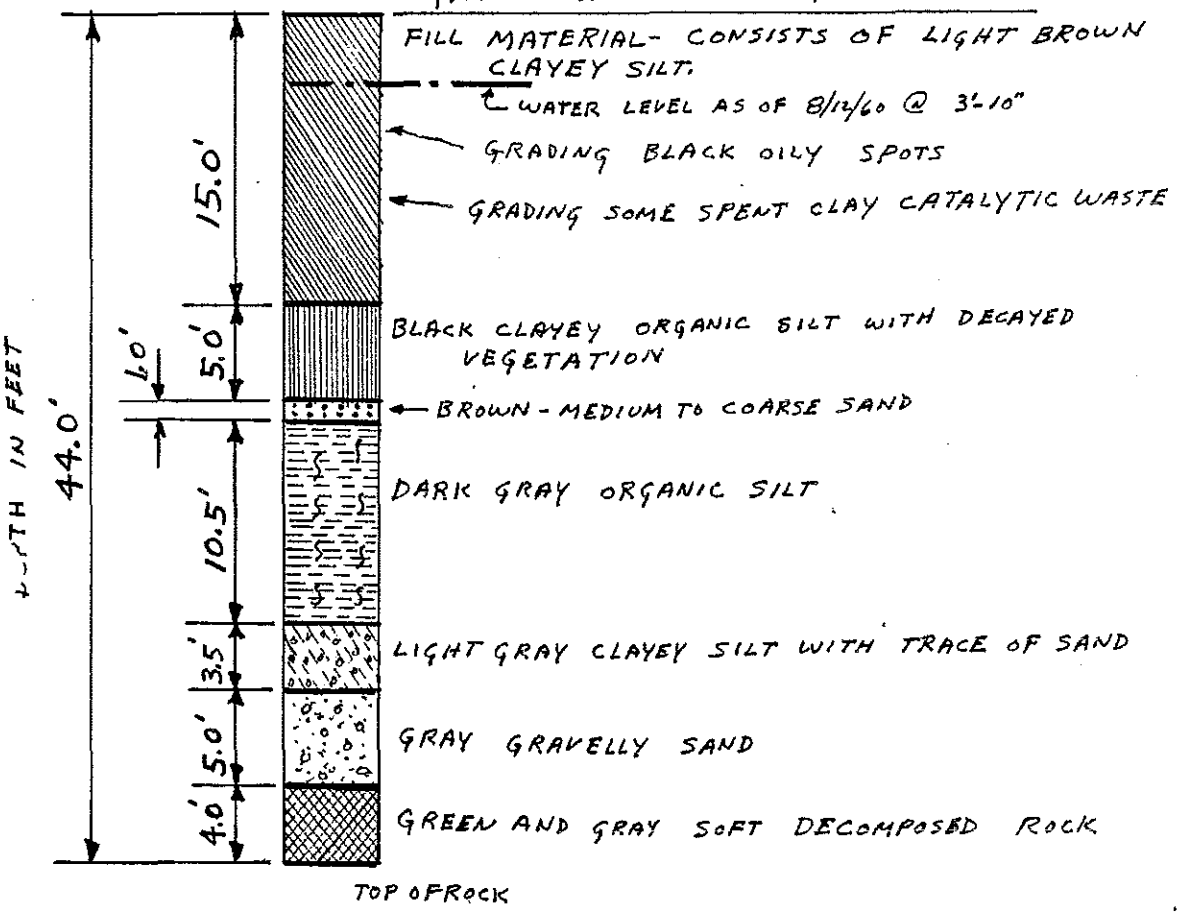
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 30 = AUG. 12, 1960

BORING LOCATION: W 16+00; S 24+70



NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

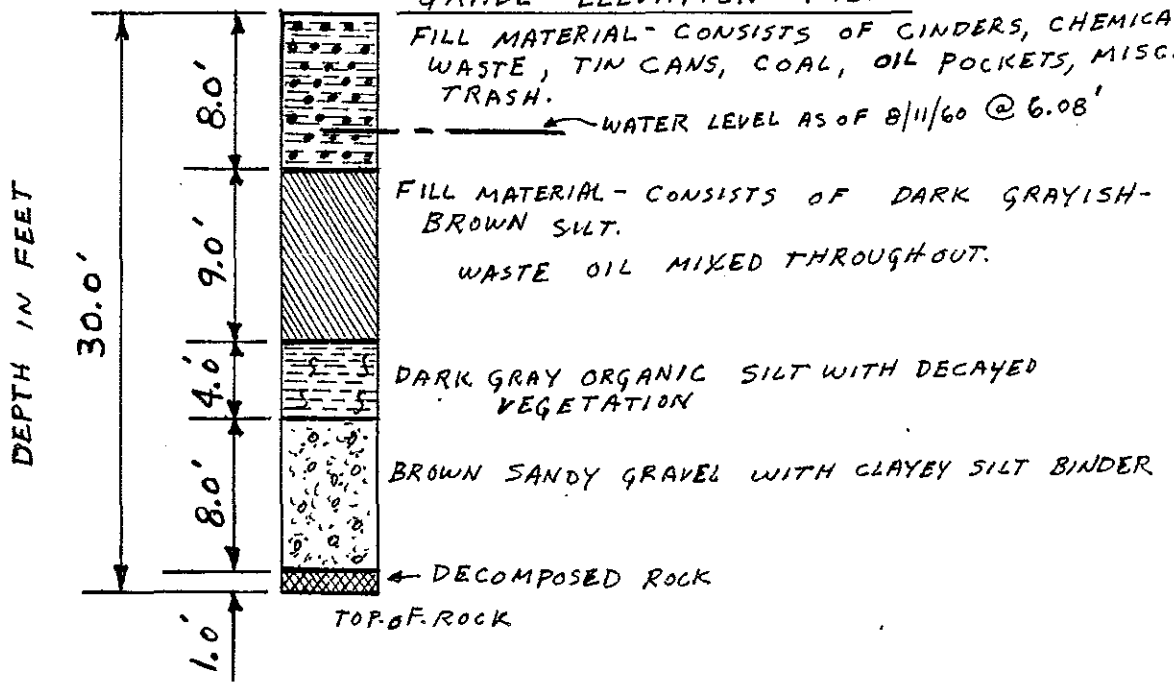
DWN: S.L. PALESE
DATE: 1/26/89
SCALE: 1"=10'-0"

LOG OF BORING No. 30
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #31 = AUG. 11, 1960

BORING LOCATION : W 15+30; S 26+30



DWN: S. L. PALESE
DATE: 1/27/89
SCALE: 1"=10'-0"

LOG OF BORING No. 31
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

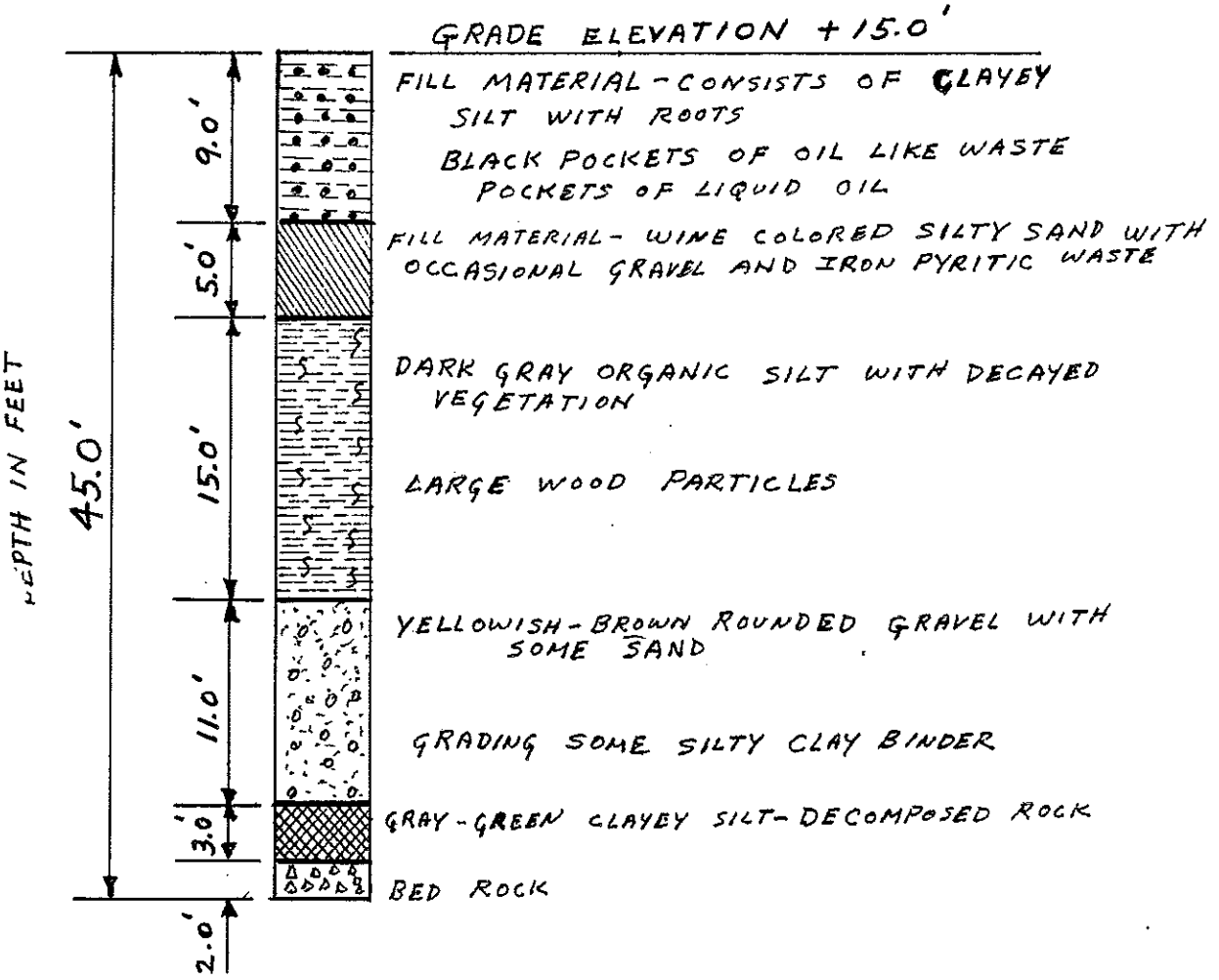
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #32: AUG. 10, 1960

BORING LOCATION: W 14+50; S 24+70



DWN: S.L. PALESE
DATE: 1/27/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 32
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

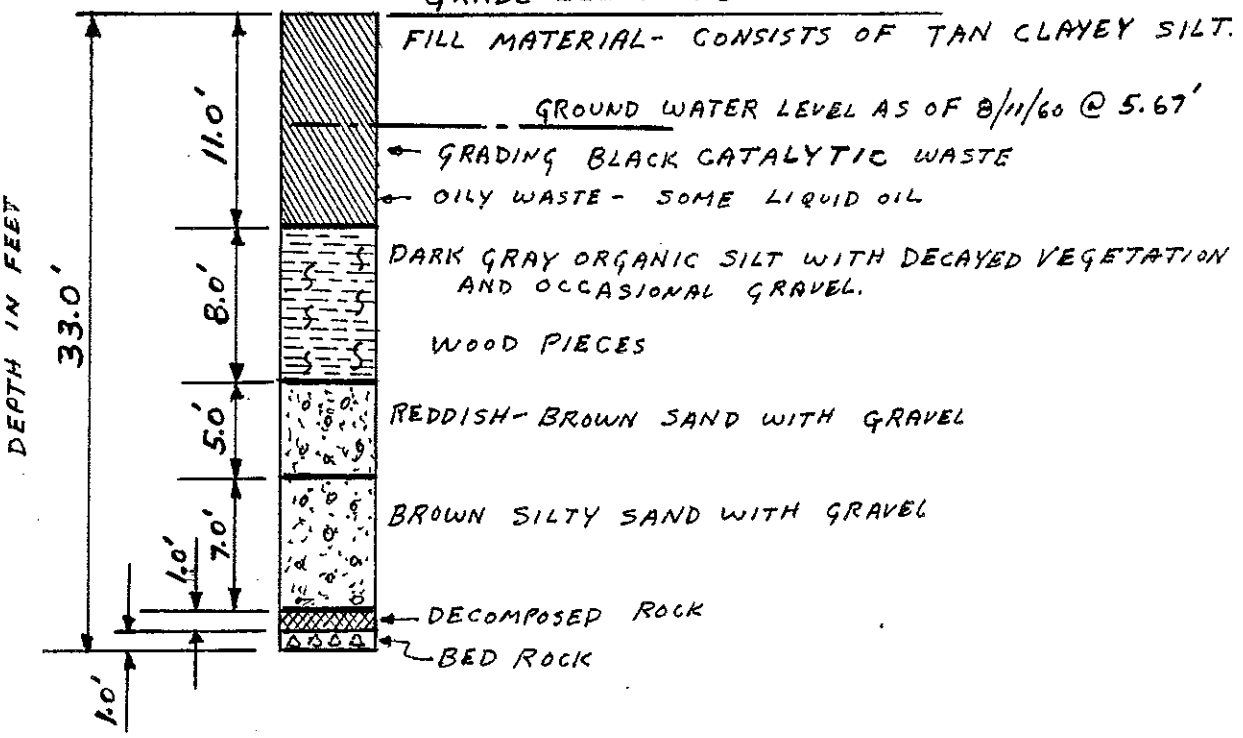
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 33 = AUG. 11, 1960

BORING LOCATION : W 12+75; S 24+70



DWN: S.L. PALESE
DATE: 1/27/89
SCALE: 1"=10'-0"

LOG OF BORING No. 33
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

NOTE:

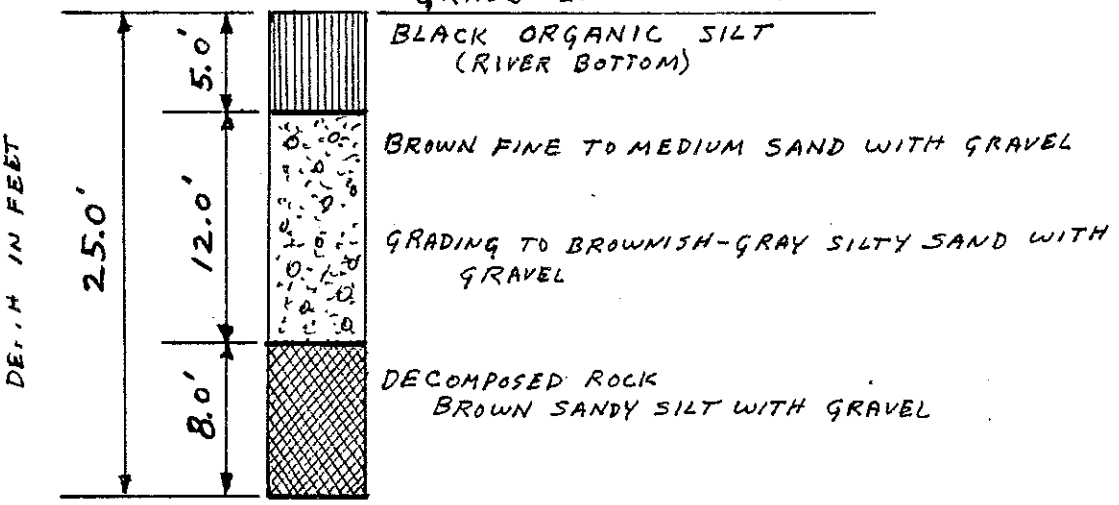
GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT.

FOR LOCATION LAYOUT OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #34 = AUG. 10, 1960

BORING LOCATION = W 12+80; S 26+50

NOTE: BORING #34 WAS UNDER WATER (DELAWARE RIVER) AT TIME OF DRILLING. THE DRILLING RIG WAS MOUNTED ON A SPECIALLY CONSTRUCTED RAFT.



NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

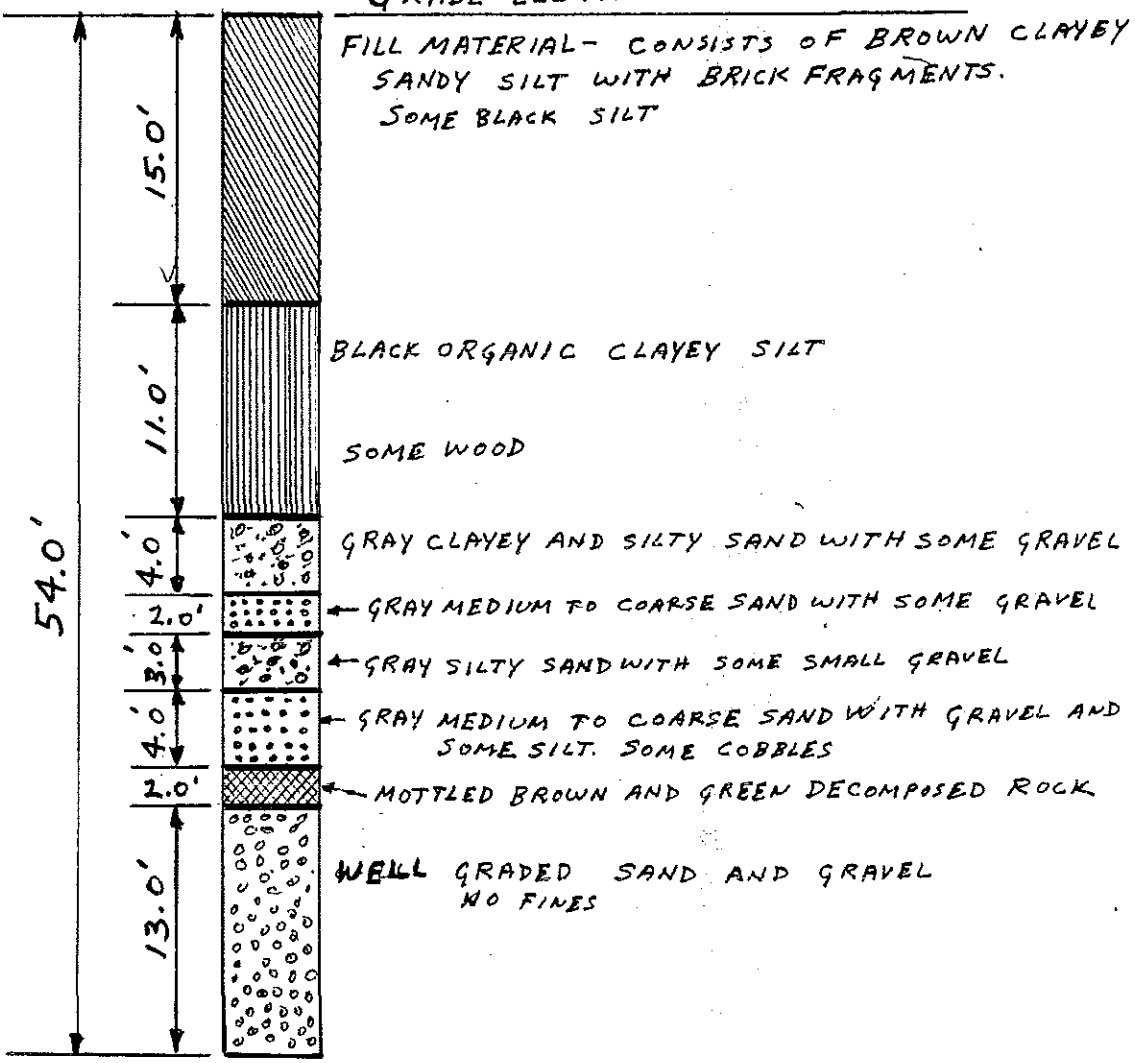
DWN: S.L. PALESE
DATE: 1/28/89
SCALE: 1"=10'-0"

LOG OF BORING No. 34
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #35 = NOV. 25, 1960

BORING LOCATION : W 18+55; S 25+90



DWN: S.L. PALESE
DATE: 1/28/89
SCALE: 1"=10'-0"

LOG OF BORING No. 35
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

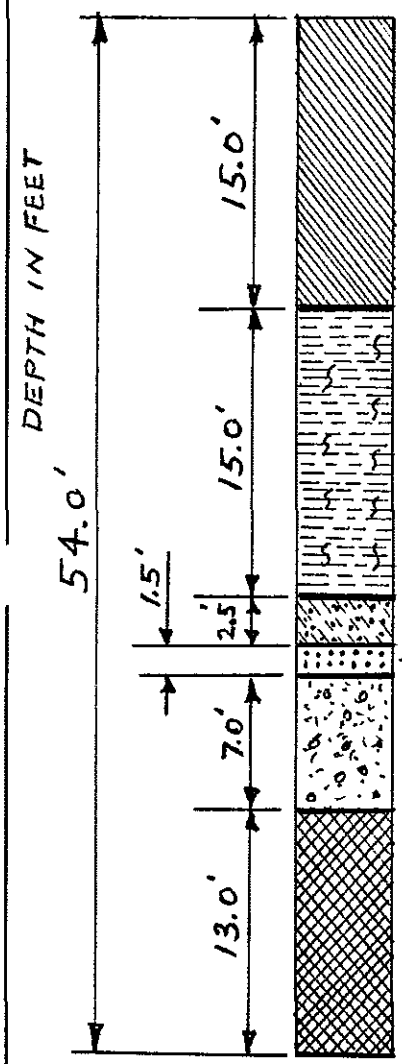
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 36 = NOV. 28, 1960

BORING LOCATION : W 18+50; S 25+70



GRADE ELEVATION + 9.1'

FILL MATERIAL- GRAY CLAYEY SILT WITH SOME CINDERS (SOFT)

DARK GRAY ORGANIC CLAYEY SILT (SOFT)

BLUISH GRAY CLAYEY SILT (FIRM)

← GRAY MEDIUM TO COARSE SAND, GRAVEL, AND COBBLES

GRAY AND BROWN SILTY SAND WITH PATCHES OF MEDIUM TO COARSE SAND AND GRAVEL

GREEN DECOMPOSED ROCK

DWN: S. L. PALESE
DATE: 1/30/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 36
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

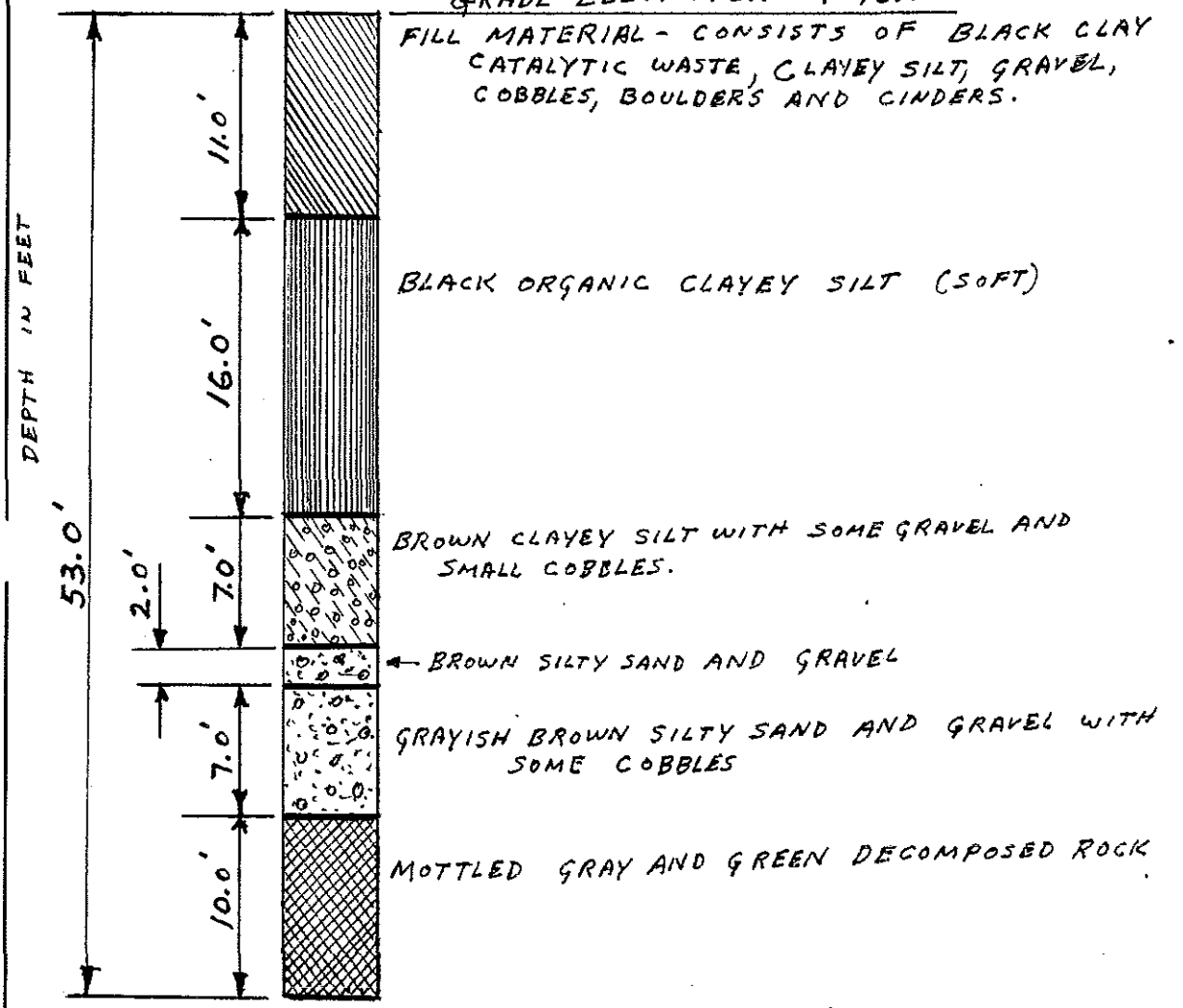
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #37: NOV. 29, 1960

BORING LOCATION: W17+85; S25+20



DWN: S.L. PALESE
DATE: 1/30/89
SCALE: 1"=10'-0"

LOG OF BORING No. 37
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

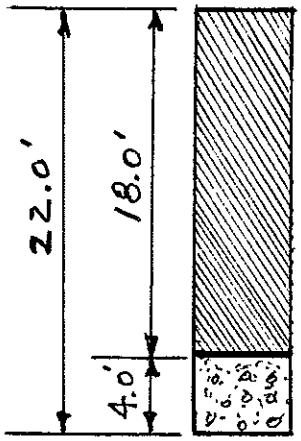
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING # 38 = FEB. 14, 1961

BORING LOCATION : W 12+25; S 25+60



GRADE ELEVATION +15.27'

FILL MATERIAL - CONSISTS OF TAN MICACEOUS CLAYEY SILT WITH SOME SAND AND GRAVEL

← SOME POCKETS OF BLACK CATALYTIC WASTE WITH OIL.

← PIECES OF CONCRETE, BRICK AND MUCH GRAVEL

BROWNISH-GRAY SILTY SAND WITH SOME GRAVEL

NOTE: GROUND WATER LEVEL AT SURFACE ON 2/15/61

NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

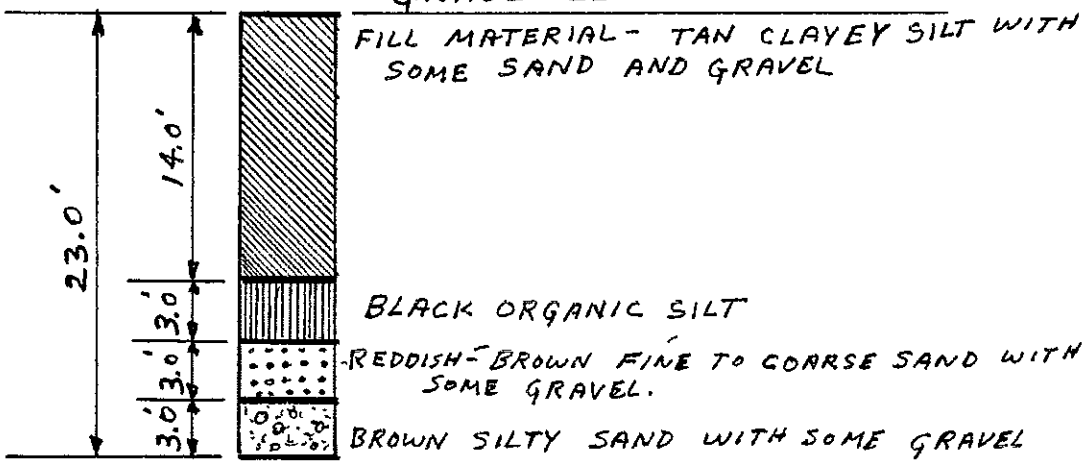
DWN: S.L. PALESE
DATE: 1/30/89
SCALE: 1"=10'-0"

LOG OF BORING No. 38
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #39 = FEB. 14, 1961

BORING LOCATION: W 11+95 ; S 26+70



NOTE: GROUND WATER LEVEL AT SURFACE ON 2/15/61

NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DWN: S.L.PALESE
DATE: 1/31/89
SCALE: 1"=10'-0"

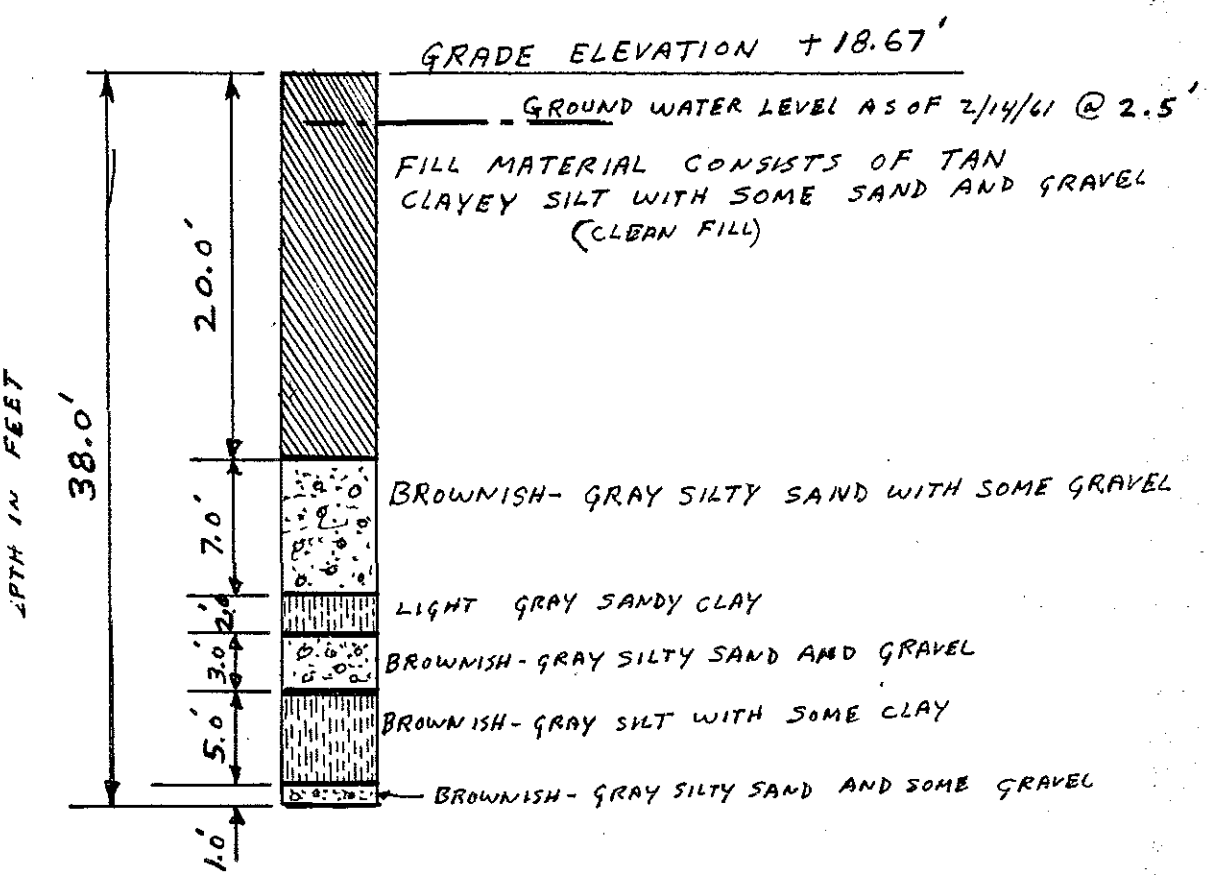
LOG OF BORING No. 39
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

SUN—41424

DATE OF BORING #40 = FEB. 14, 1961

BORING LOCATION : W 12+55; S 26+70



NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

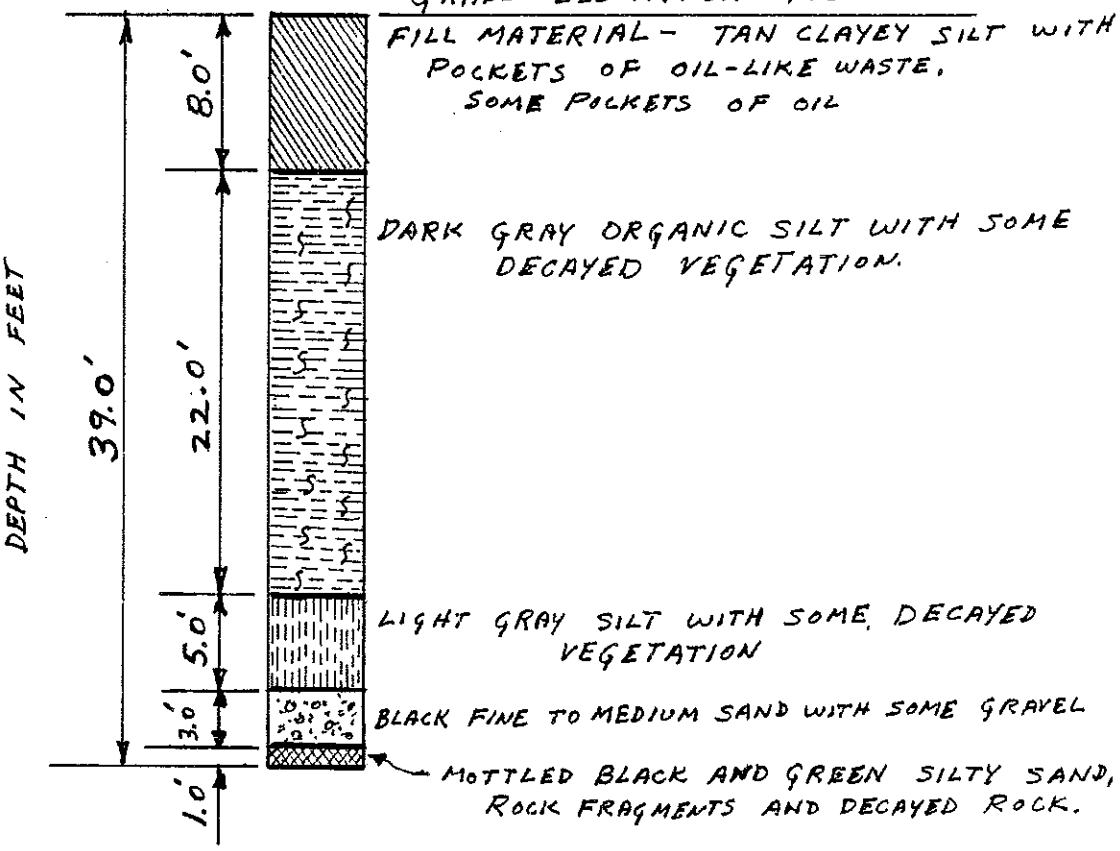
DWN: S.L. PALESE
DATE: 1/31/89
SCALE: 1"=10'-0"

LOG OF BORING No. 40
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING # 41 = FEB. 15, 1961

BORING LOCATION : W 16+20; S 22+10



NOTE: WATER LEVEL AT SURFACE ON 2/15/61

NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DWN: S.L. PALESE
DATE: 1/31/89
SCALE: 1"=10'-0"

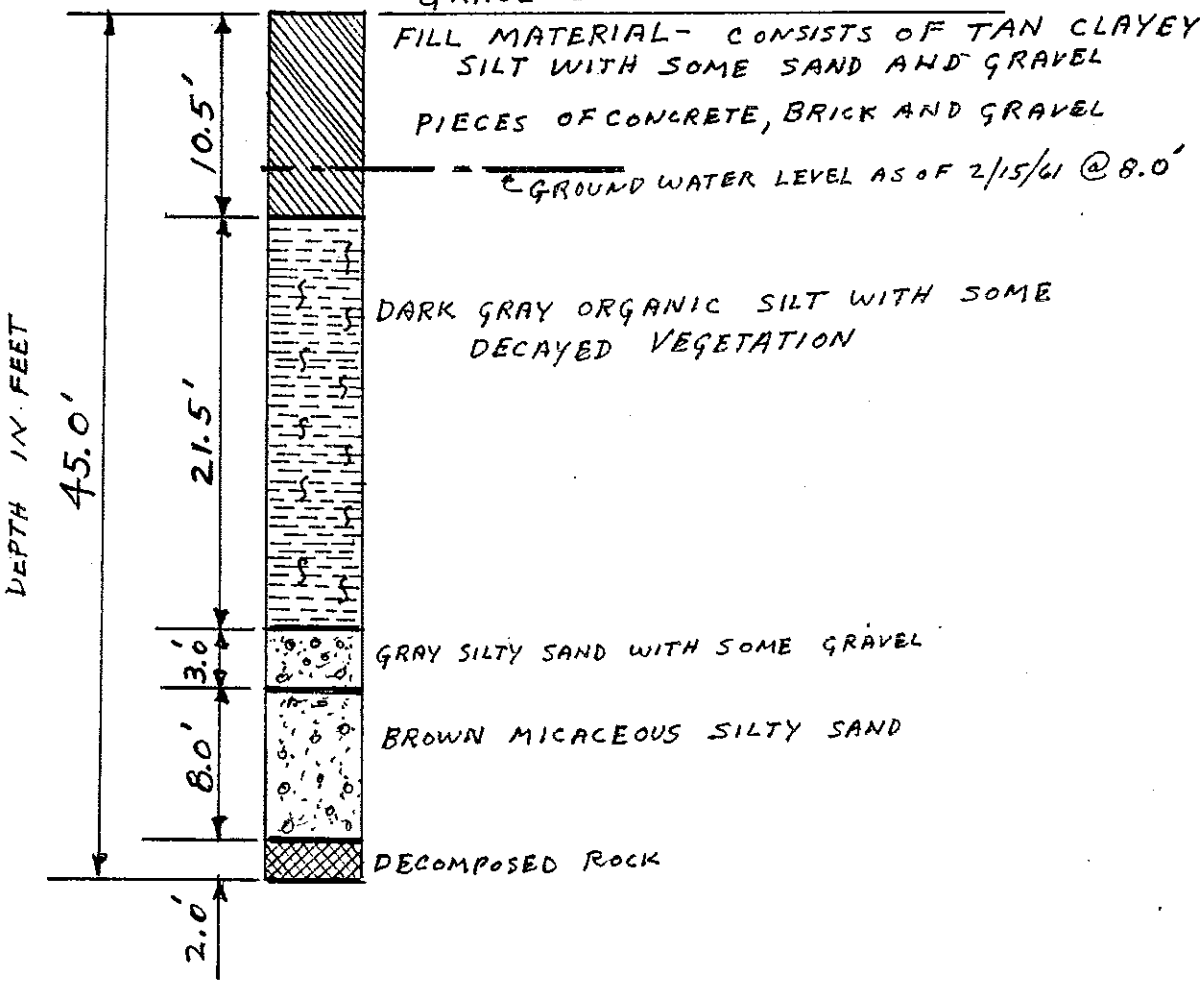
LOG OF BORING No. 41
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

SUN—41424

DATE OF BORING # 42 = FEB. 15, 1961

BORING LOCATION : W 17+80 ; S 22+30



NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

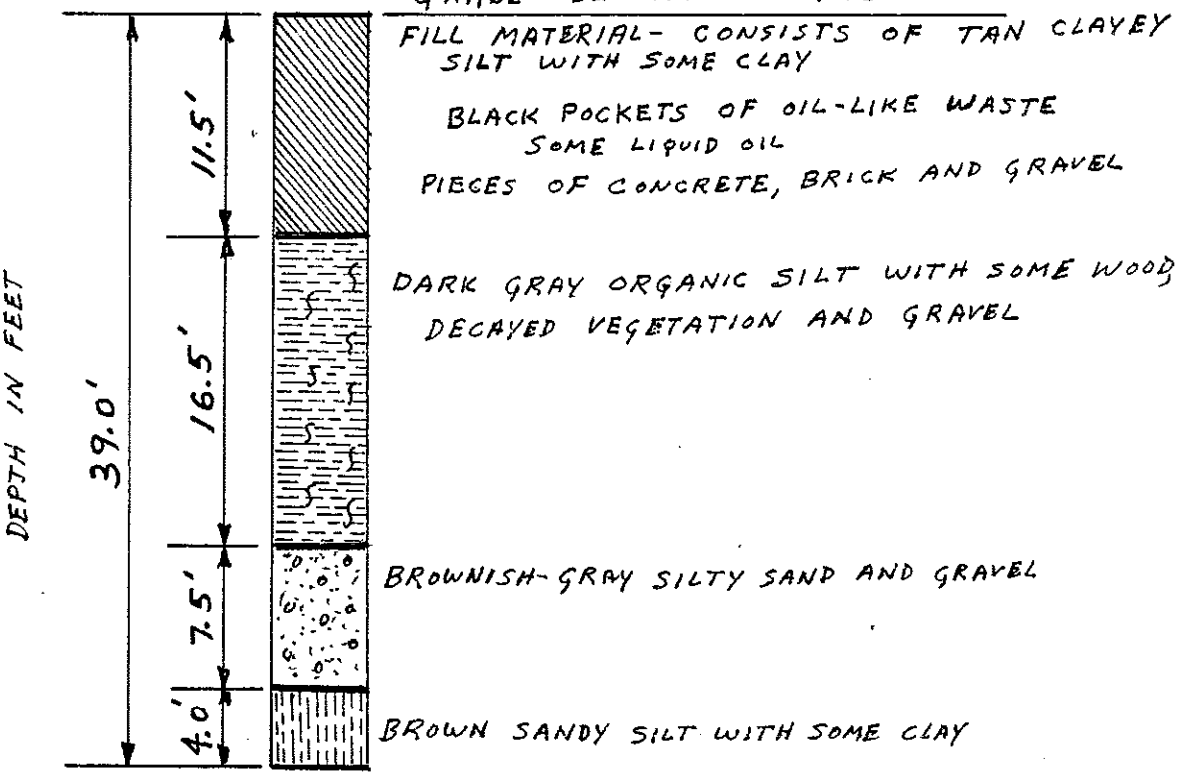
DWN: S.L. PALESE
DATE: 2/1/89
SCALE: 1"=10'-0"

LOG OF BORING No. 42
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

DATE OF BORING #43 = FEB. 15, 1961

BORING LOCATION : W 17+80; S 23+10



NOTE : WATER LEVEL AT SURFACE ON 2/15/61

DWN: S.L. PALESE
DATE: 2/1/89
SCALE: 1"=10'-0"

LOG OF BORING No. 43
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

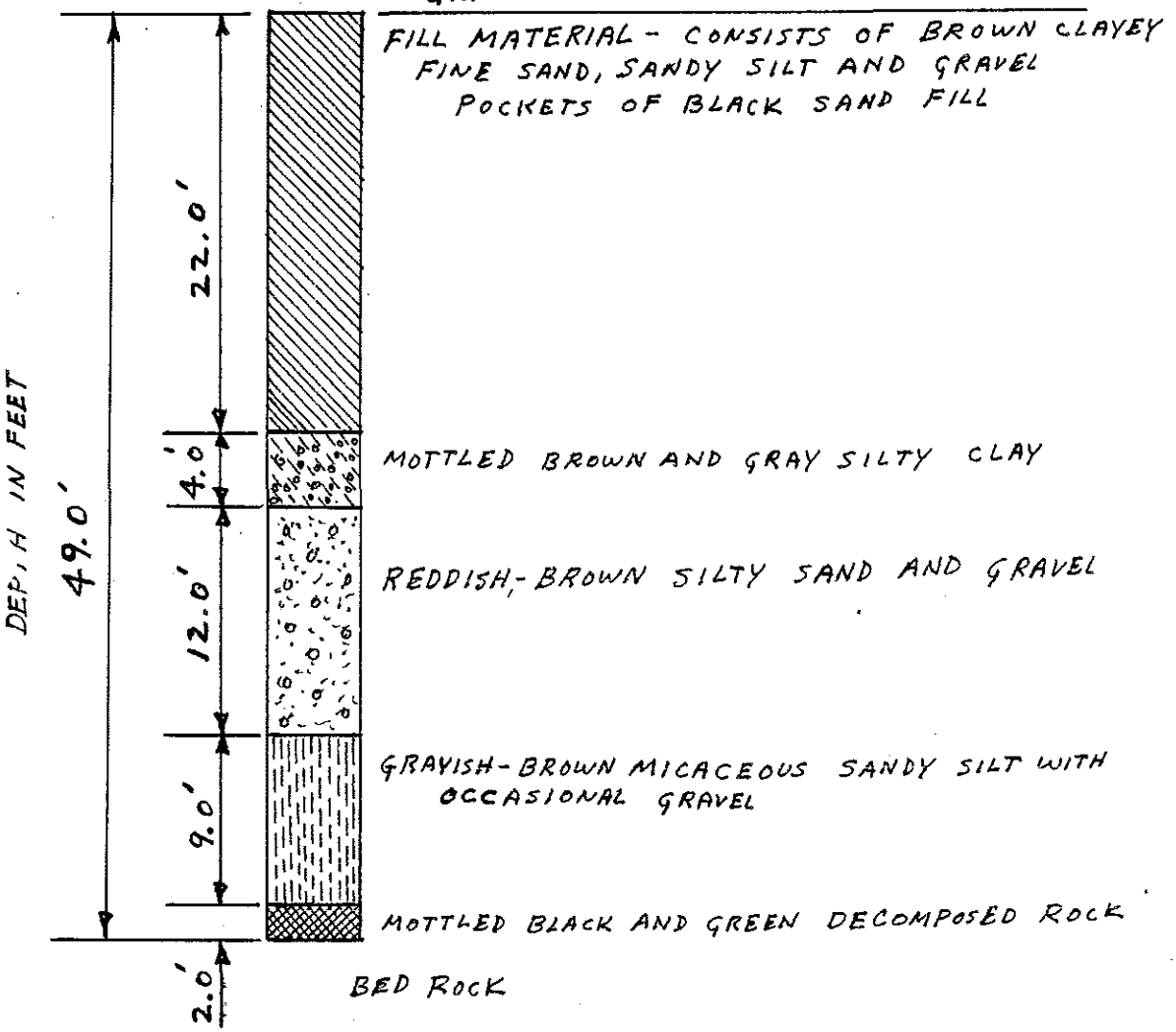
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #44 = AUG. 15, 1961

BORING LOCATION: W 11+75; S 28+30



DWN: S.L. PALESE
DATE: 2/1/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 44
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

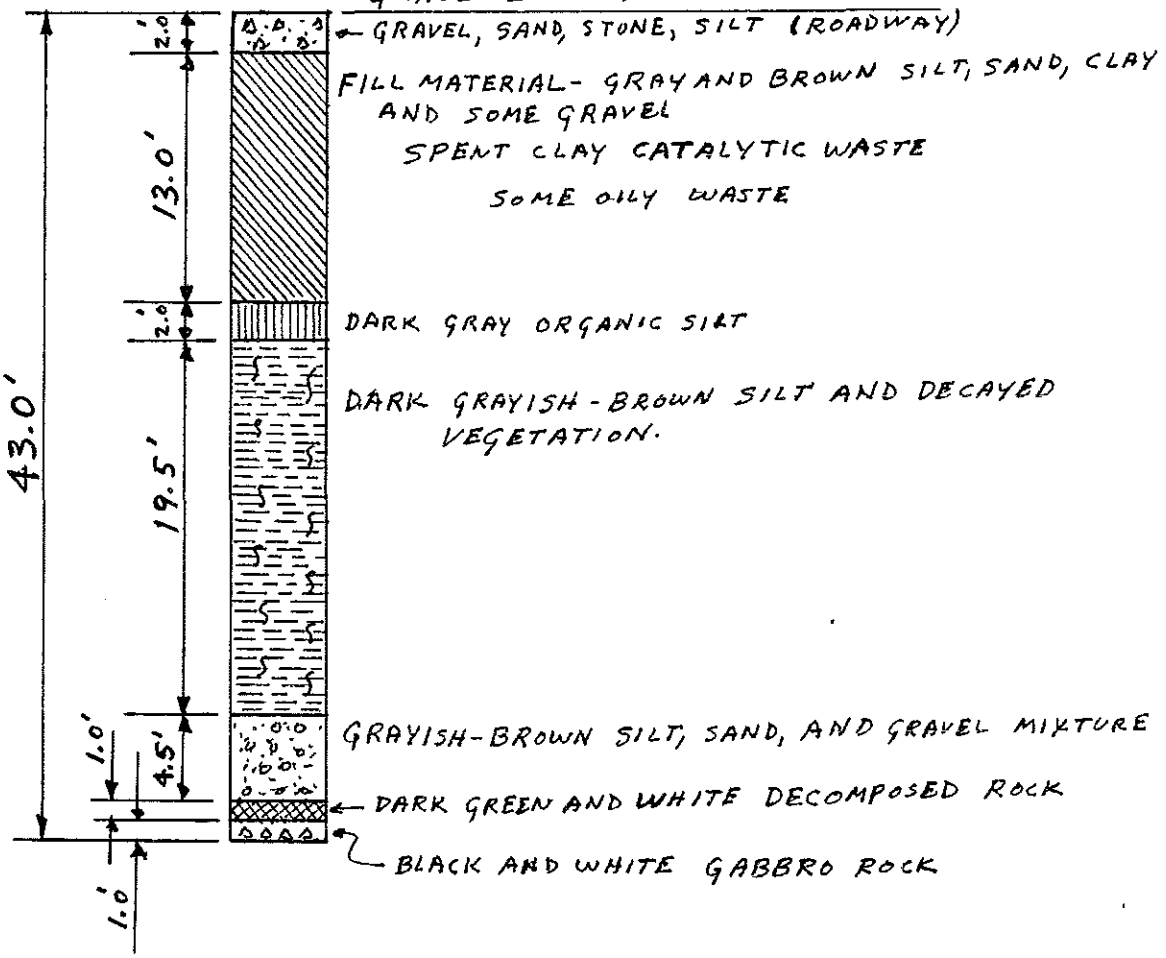
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #45 = SEPT. 19, 1962

BORING LOCATION: W 14+40; S 26+65



DWN: S. L. PALESE
DATE: 2/2/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 45
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

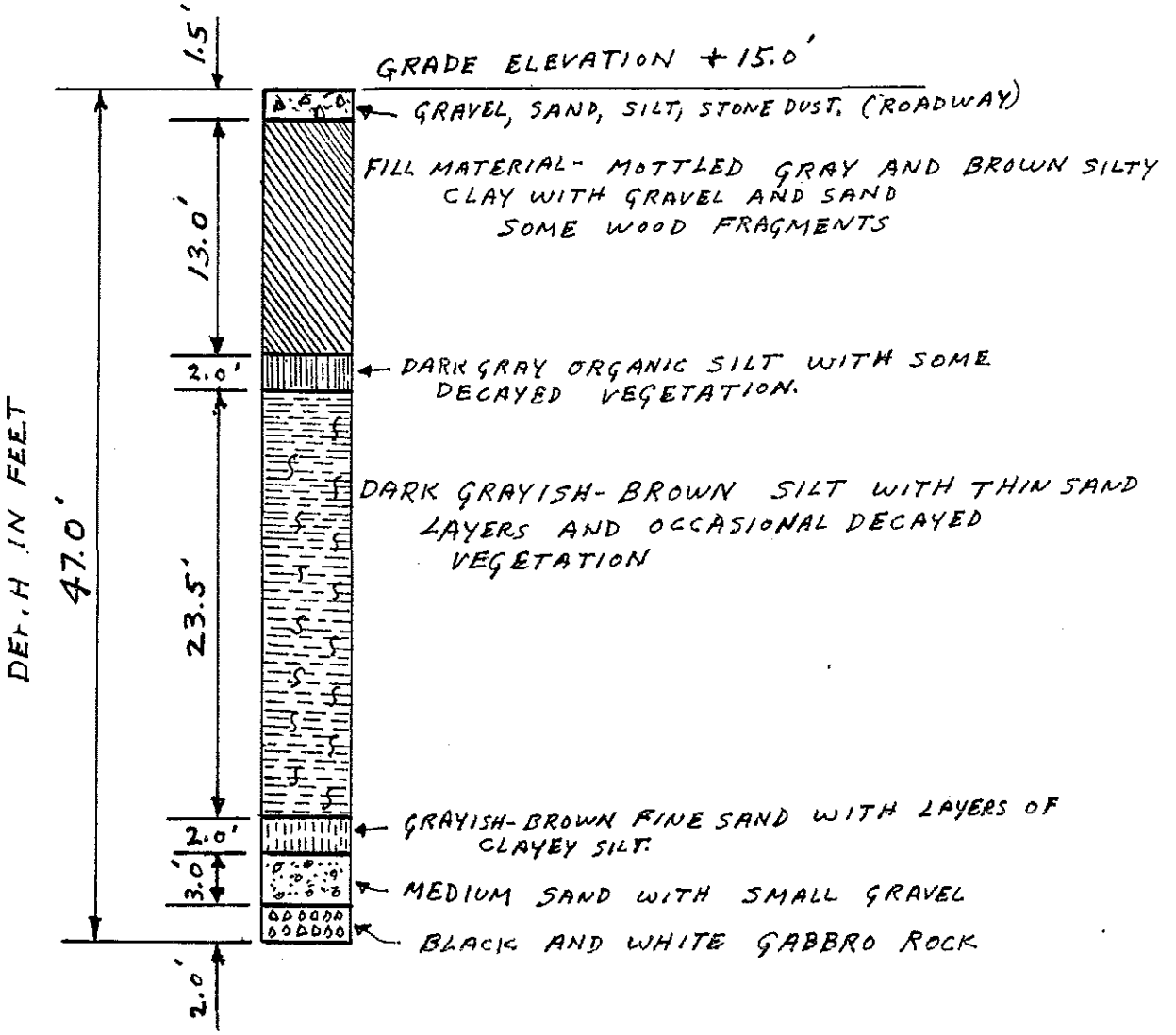
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089

DATE OF BORING #46 = SEPT. 20, 1962

BORING LOCATION : W 14+40; S 27+20



DWN: S.L. PALESE
DATE: 2/2/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 46
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

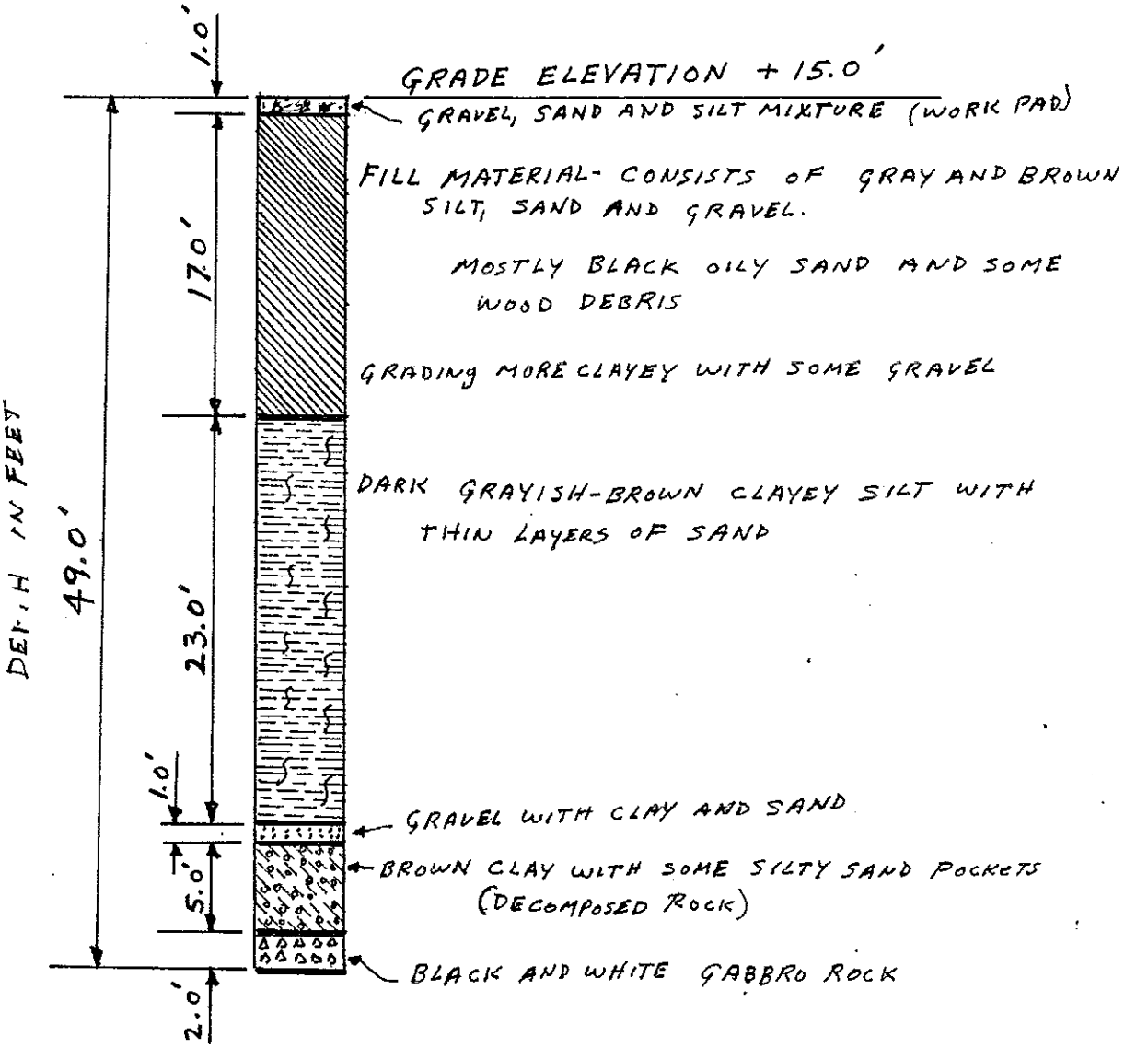
NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF +15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089.

DATE OF BORING # 47 = SEPT. 20, 1962

BORING LOCATION : W 16+25; S 27+30



DWN: S.L. PALESE
DATE: 2/2/89
SCALE: 1" = 10'-0"

LOG OF BORING No. 47
ETHYLENE COMPLEX

SUN CO.
PROC. ENG.
MARCUS HOOK, PA

NOTE:

GRADE ELEVATION BASED ON SUN OIL PLANT DATUM ELEVATION OF + 15.0 FT.

FOR LAYOUT LOCATION OF ALL BORINGS SEE DRAWING 12-18-E-11089